1.0 INTRODUCTION

Since 1992, extensive information has been gathered and preliminary evaluation has been completed concerning the potential environmental effects associated with numerous high-speed train corridor alternatives throughout California. From feasibility studies through conceptual design, a variety of technical studies have been undertaken to address the engineering, operational, financial, ridership, and environmental aspects of such a system. The findings of these studies concluded that California would benefit substantially from high-speed train transportation. Because of the anticipated benefits and the proven need for additional transportation options, the further evaluation of a high-speed train system is seen as the next logical step in the development of California's transportation infrastructure.

The current stage of project development for a statewide high-speed train system is designed to further optimize alignments, avoid/minimize environmental impacts, and develop a more accurate cost figure based on a more refined level of engineering and environmental analysis. As such, the California High-Speed Rail Authority (Authority) has initiated a formal environmental clearance process through the preparation of a state program-level Environmental Impact Report (EIR) and a federal Tier I Environmental Impact Statement (EIS) or Program EIR/EIS. The Program EIR/EIS will satisfy the requirements of the California Environmental Quality Act (CEQA) and National Environmental Policy Act (NEPA) for the first tier of environmental review. As part of the Program EIR/EIS, a number of alternatives are being evaluated including a No-Build Alternative, High-Speed Train Alternative(s), and Other Modal Alternatives (aviation, highway, and conventional passenger rail).

To accomplish this program environmental effort, the Authority has divided the state study area into five regions: Bay Area-to-Merced, Sacramento-to-Bakersfield, Bakersfield-to-Los Angeles, Los Angeles-Orange County-San Diego, and Los Angeles-to-San Diego via the Inland Empire.

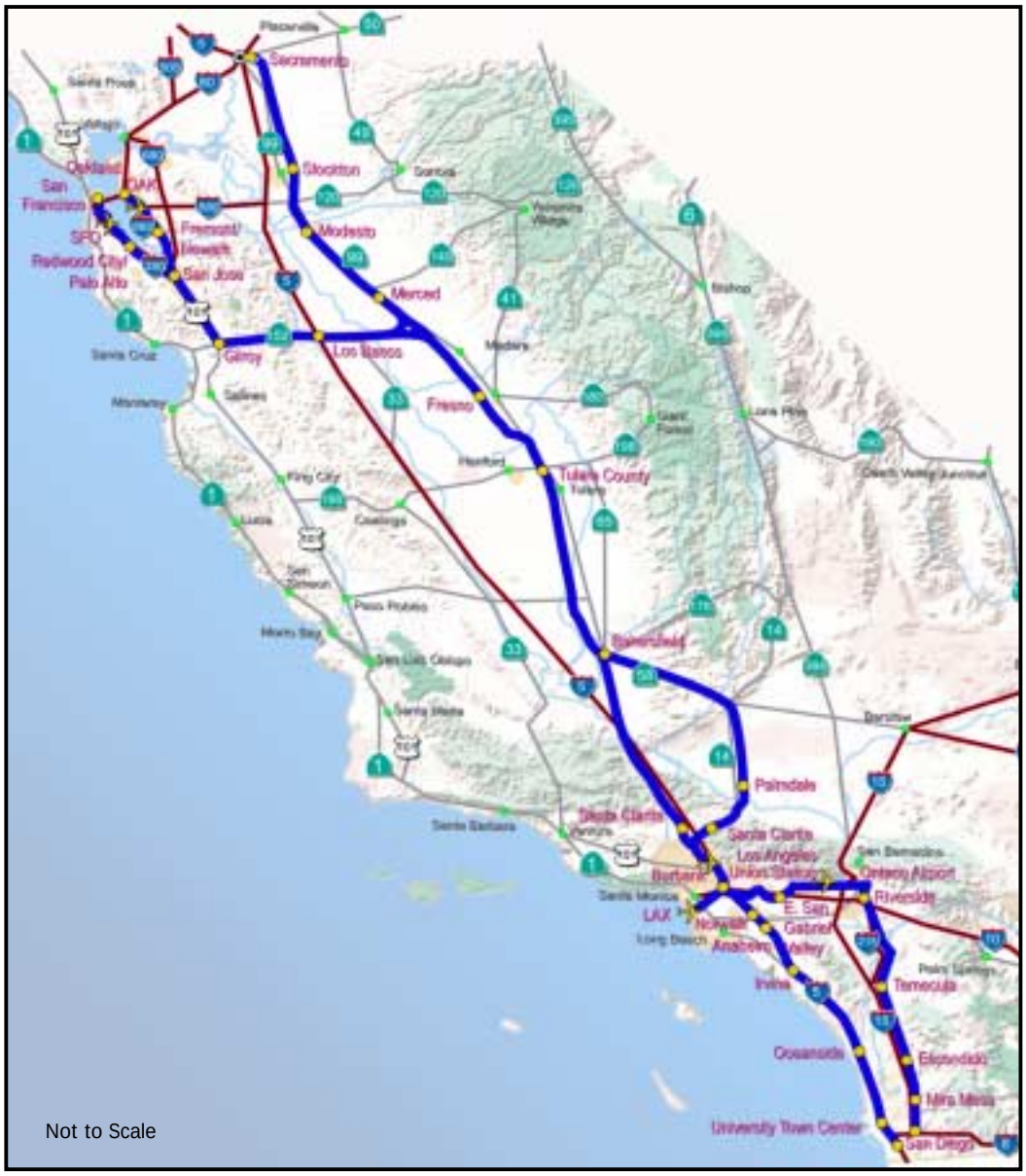
1.1 PURPOSE

Within the High-Speed Train Alternative, there is a range of high-speed train alignment and station location options to be considered. The majority of these options has been evaluated in prior studies and has been presented to the previous California Intercity High-Speed Rail Commission and the current Authority. Some corridors were carried forward for further consideration while others have been removed from further study based on their relative merit and viability for potential implementation as part of a statewide high-speed train system. Those corridors that have been carried forward are illustrated in Figure 1.1-1 and documented in the Authority's June 2000, *Final Business Plan*[1] and the December 1999, *California High-Speed Rail Corridor Evaluation*.[2]

The purpose of the Alignment Screening Evaluation is to consider all reasonable and practical alignment and station options at a consistent level of analysis and focus the program environmental analysis on the most viable of these alignment and station options. The initial set of alignments and station locations was identified by reviewing prior Commission and Authority studies, through meetings with elected officials, and through the environmental scoping process.

[1] California High-Speed Rail Authority. *Building a High-Speed Train System for California, Final Business Plan*, June 2000.
[2] Parsons Brinckerhoff. *California High-Speed Rail Corridor Evaluation.* Prepared for California High-Speed Rail Authority, December 1999.

Figure 1.1-1
Recommended Corridors to be Studied in the Environmental Process



Source: California High-Speed Rail Authority. *Building a High-Speed Train System for California, Final Business Plan,* 2000.

The results of this screening process and information differentiating the alignment and station options are documented herein for the Bay Area-to-Merced region. Similar reports are being prepared for the other four regions. Each of the region screening reports will be summarized into a Statewide High-Speed Train Alignments/Stations Screening Evaluation that will be presented to the Authority Board. Based on recommendations by the Authority staff, the Board will select alignments and stations to be carried forward for more detailed analysis in the Program EIR/EIS.

1.2 BACKGROUND

The California Intercity High-Speed Rail Commission was established in 1993 by Senate Concurrent Resolution (SCR) 6 to investigate the feasibility of a high-speed train system for California, specifically, a system connecting the San Francisco Bay Area, Los Angeles, San Diego, and Sacramento. To address this question of feasibility, the Commission successfully conducted a series of technical studies encompassing ridership and revenue forecasts; economic impact and benefit cost analyses; institutional and financing options; corridor evaluation and environmental impacts and constraints analyses; and preliminary engineering feasibility studies. Based on these studies, the Commission determined that a high-speed train system is technically, environmentally, and economically feasible and set forth recommendations for the technology, corridors, financing, and operation for this system.

The California High-Speed Rail Authority was created by the state Legislature in 1996 (Chapter 796 of the Statutes of 1996 — Senate Bill 1420, Kopp and Costa) to be an implementing agency that would construct, operate, and fund a statewide, intercity high-speed passenger rail system. Based on recently completed studies, evaluations, and previous analysis, the Authority has developed a plan to implement a statewide high-speed train system in California. The current proposal is presented in the Authority's *Business Plan*. The plan describes a 700-mile (1,126-kilometer) -long system capable of speeds in excess of 200 miles per hour (mph) (320 kilometers per hour [km/h]) on dedicated, fully grade-separated route with state-of-the-art safety, signaling, and automated train control systems. The system would serve the major metropolitan centers of California.

Beginning in 1992, several studies pertaining to planning, engineering, ridership/revenue, financing, and economic impact have been completed under the direction of the California Department of Transportation (Caltrans), the past Commission, and the current Authority. These studies provided information that formed the basis of the decisions made and direction of the continuing studies. Because of the nature of this initial screening evaluation, this report primarily references the three planning and engineering studies that have been completed. While these studies differed in terms of their specific scopes of work, they all shared the common focus of identifying potential corridors for the implementation of high-speed train lines and evaluating the feasibility and viability of these corridors. Analysis of environmental constraints through use of existing databases and identification of potential impacts were key components of these studies. The studies were completed in consecutive order, allowing for each subsequent study to benefit from, and build on, the work completed in the prior study. Each of the three studies is described in detail in the *California High-Speed Rail Corridor Evaluation - Environmental Summary Report.*[3] Public involvement was an important part of the feasibility studies. The public was updated on the study progress and key decision points with newsletters and access to the Authority's website.

1.2.1 Los Angeles – Bakersfield Preliminary Engineering Feasibility Study (1994)[4]

Completed in 1994, this study analyzed the feasibility of constructing a high-speed train crossing of the Tehachapi Mountains in Southern California. After considering a broad range of alignments, the study focused on the most viable routes. Two main corridors between Los Angeles and Bakersfield were considered feasible in terms of cost, travel time, and environmental impact: I-5 Grapevine and Palmdale-Mojave. The corridors studied traversed a variety of terrain (urban development, mountains, valley floor, etc.), allowing the engineering and costing analyses to be applicable to other portions of the state.

[3] Parsons Brinckerhoff. *California High-Speed Rail Corridor Evaluation - Environmental Summary.* Prepared for California High-Speed Rail Authority, April 2000.
[4] Parsons Brinckerhoff. *Los Angeles - Bakersfield High-Speed Ground Transportation Preliminary Engineering Feasibility Study Final Report*. Prepared for Caltrans, December 1994.

Because of this applicability, work performed for the Los Angeles–Bakersfield study provided an important foundation for the subsequent statewide corridor evaluation studies.

1.2.2 California High-Speed Rail Corridor Evaluation and Environmental Constraints Analysis (1996)[5]

This study was conducted in three phases and was completed in 1996. The first phase defined the most promising corridor alignments for linking the San Francisco Bay Area and Los Angeles. During the second phase, these corridors between Los Angeles and the Bay Area were examined in more detail. The third phase examined potential high-speed train system extensions to Sacramento, San Bernardino/Riverside, Orange County, and San Diego. The study identified station locations and estimated travel times; developed construction, operation, and maintenance cost estimates; analyzed environmental constraints and possible mitigation measures; and, in an iterative process with the Ridership Study, developed a conceptual operating plan. The corridors recommended for further study in Phases 2 and 3 were refined in the corridor evaluation studies completed by the Authority.

1.2.3 California High-Speed Rail Corridor Evaluation (2000)[6]

In September of 1998, the Authority commissioned a *Corridor Evaluation* study to assess and evaluate the viability of various corridors throughout the state for implementation as part of a statewide high-speed train system. To address new issues raised by local and regional agencies, further corridor investigations and evaluations were conducted in several areas of the State and compared in the context of updated information on previously studied routes. The Authority was mandated to move forward in a manner that was consistent with, and continued the work of the Commission. Using the Commission's recommended corridors as a foundation, potential corridors were further evaluated on the basis of capital, operating and maintenance costs; travel times; and engineering, operational, and environmental constraints. The corridors were compared and evaluated on a regional basis and as part of a statewide system. From this study, the Authority identified corridors to be included in the current stage of project development as part of the Program EIR/EIS.

[5] Parsons Brinckerhoff. *California High-Speed Rail Corridor Evaluation and Environmental Constraints Analysis.* Prepared for California Intercity High-Speed Rail Commission, June 1996.
[6] Parsons Brinckerhoff. *California High-Speed Rail Corridor Evaluation.* Prepared for California High-Speed Rail Authority, December 1999.

2.0 PARAMETERS/ASSUMPTIONS AND EVALUATION METHODOLOGY

Unless otherwise noted, the objectives, parameters, criteria, and methodologies described in this report are consistent with those applied in previous California high-speed train studies and documented in the *California High-Speed Train Program EIR/EIS*, *Task 1.5.2 – High-Speed Train Alignment/Station Screening Evaluation Methodology*.[7]

2.1 PARAMETERS/ASSUMPTIONS

High-speed train alignment and station options were developed through consistent application of system, engineering, and operating parameters as described in Task 1.5.2. The parameters and assumptions applied are consistent with those applied in previous planning and engineering studies and are based on accepted engineering practice, the criteria and experiences of other railway and high-speed train systems, and recommendations of VHS and maglev manufacturers.

2.1.1 Statewide Parameters/Assumptions

The design, cost, and performance parameters used in developing the alignment and station options are based on two technology groups (classified by speed) (Figure 2.1-1). The Very High Speed (VHS) group includes trains capable of maximum operating speeds near 220 mph (350 km/h) utilizing steel-wheel-on-steel-rail technology. Requirements for a VHS system include a dedicated, fully grade-separated right-of-way (ROW) with overhead centenary for electric propulsion. It is possible to integrate a VHS system into existing conventional rail lines in congested urban areas given resolution of certain equipment and operating compatibility issues. The magnetic levitation (maglev) group utilizes magnetic forces to lift and propel the train along a guideway and is designed for maximum operating speeds above that of VHS technology. A maglev system requires a dedicated guideway and may share ROW but not track with conventional train systems.

Figure 2.1-1: VHS and Maglev Technology

VHS Train (Germany ICE)

Maglev (Transrapid)

[7] Parsons Brinckerhoff. *California High-Speed Train Program EIR/EIS, Task 1.5.2 – High-Speed Train Alignments/Stations Screening Evaluation Methodology*. Prepared for California High-Speed Rail Authority, May 2001.

High-speed train system engineering design parameters used in developing the alignments were documented in Task 1.5.2 and include speeds, geometry, and clearances for both steel-wheel-on-steel-rail (VHS) and maglev high-speed train technologies. The parameters and criteria, summarized in Table 2.1-1, are consistent with previous California high-speed train studies and are based on accepted engineering practice, the criteria and experiences of other railway and high-speed train systems, and recommendations of VHS and maglev manufacturers.

Table 2.1-1
Summary of Engineering Design Parameters

Parameter	Very High-Speed	Maglev
Double Track	Full	Full
Power Source	Electric	Electric
Grade Separations	Full	Full
POTENTIAL FOR SHARED USE	Yes	No
Corridor Width		
❑ **Desirable**	100 ft (30.4 m)	100 ft (30.4 m)
❑ **Minimum**	50 ft (15.2 m)	50 ft (15.2 m)
Top Speed	220 mph (350 km/h)	240 mph[(1)] (385 km/h)
Average Speed	125-155 mph (200-250 km/h)	145-175 mph (230-280 km/h)
Acceleration	0.4-1.3 mph/s[3] (0.6-2.1 km/h/s[4])	1.1-1.9 mph/s (1.8-3.2 km/h/s)
Deceleration	1.2 mph/s (1.9 km/h/s)	1.8 mph/s (2.9 km/h/s)
MINIMUM HORIZONTAL RADIUS	500-650 ft (150-200 m)	1,150 ft (350 m) (2)
Minimum Horizontal Radius (at top speed)	15,600 ft @ 220 mph (4,750 m @ 350 km/h)	11,500 ft @ 240 mph (3,500 m @ 385 km/h)
Superelevation		
❑ **Actual (Ea)**	7 in (180 mm)	16°
❑ **Unbalanced (Eu)**	5 in (125 mm)	5°
Grades		
❑ **Desirable Maximum**	3.5%	NA
❑ **Absolute Maximum**	5.0%	10.0%
Minimum Vertical Radius Crest Curve (at top speed)	157,500 ft @ 220 mph (48,000 m @ 350 km/h)	205,700 ft @ 240 mph (62,700 m @ 385 km/h)
Minimum Vertical Radius Sag Curve (at top speed)	105,000 ft @ 220 mph (32,000 m @ 350 km/h)	137,100 ft @ 240 mph (41,800 m @ 385 km/h)
Horizontal Clearance (centerline of track to face of fixed object)	10 ft 4 in @ 220 mph (3.1 m @ 350 km/h)	9 ft 5 in @ 240 mph (2.8 m @ 385 km/h)
Vertical Clearance (top of rail to face of fixed object)	21 ft (6.4 m)	12 ft 2 in (3.7 m)
Track Centerline Spacing	15 ft 8 in @ 220 mph (4.7 m @ 350 km/h)	15 ft 9 in @ 240 mph (4.8 m @ 385 km/h)
Minimum Right-of-Way Requirements		
At-Grade/Cut-and-Fill/Retained Fill	50 ft (15.2 m)	47 ft (14.3 m)
Aerial Structure	50 ft (15.2 m)	49 ft (15 m)
Tunnel (Double Track)	67 ft (20.4 m)	67 ft (20.4 m)
Tunnel (Twin Single Track)	120 ft (36.6 m)	120 ft (36.6 m)
Trench/Box Section	70 ft (21.3 m)	73 ft (22.2 m)
Minimum Station Platform Length	1,300 ft (400 m)	1,300 ft (400 m)
Minimum Station Platform Width	30 ft (9 m)	30 ft (9 m)

Notes: 1- Top Speed Defined in Federal Maglev Deployment Plan
2- Transrapid USA, 1998.
3- mph/s – miles per hour-second
4- km/h/s – kilometers per hour-second

Based on the minimum requirements listed in Table 2.1-1, three general ROW parameters were utilized for the screening evaluation: (1) a minimum ROW corridor of 50 feet (15.2 meters) was assumed in congested corridors; (2) a 100-foot (30.4-meter) corridor was assumed in less developed areas to allow for drainage, future expansion and maintenance needs; and (3) a wider corridor was assumed in variable terrain to allow for cut and fill slopes and tunnels.

The overall operations strategy and conceptual service parameters that were assumed for high-speed train service in California are documented in Task 1.5.2. Specific scheduling and operations modeling analysis is currently underway and will be used in future detailed engineering and environmental analyses in the next phase of this study.

2.1.2 Bay Area-to-Merced Corridor Parameter/Assumption Variances

Variances to the state-wide parameters and assumptions described above were applied for the Bay Area-to-Merced corridor. These variances and their underlying reasons are described below.

A. CALTRAIN SHARED USE OPTIONS

The Caltrain Shared Use options described in this report assumes the shared use of Caltrain commuter rail tracks by high-speed trains. These options would apply only for the steel-wheel-on-rail high-speed train technologies. To allow for potential incremental implementation of a high-speed train system, two Caltrain Shared Use options are evaluated:

A Basic Service Option, which would include grade separation of road crossings and fencing of the entire at-grade portion of the Caltrain corridor; however, four track-stations are not assumed at all local stations for this Option. Some local stations would be three-track and some two.

A Four-Track Station Option that would be consistent with the established criteria, allowing for high-speed trains to pass through or bypass local Caltrain stations on separate tracks.

FRA regulations currently prohibit operation of high-speed trains on tracks also used by freight trains, unless such trains can meet specific FRA criteria regarding “crash worthiness.” Currently, the high-speed train equipment in use in Europe and Japan does not meet the FRA criteria. This report assumes that high-speed trains will be able to share tracks that would also be used both by Caltrain commuter rail and freight trains, i.e., that the issues regarding shared use track by freight and high-speed trains will be overcome. Possible resolution of this issue could occur via: (1) the temporal separation of high-speed and freight trains, (2) the removal of the freight trains from the lines (with commencerate provisions for freight access to the business served), (3) changes to high-speed train equipment to make it “crash worthy,” and/or (4) revision to the FRA regulations.

An additional issue that will need to be addressed with shared use operation concerns clearances to platforms. Caltrain stations have low (eight inches above top of rail maximum) platforms. This is due to California Public Utiltities Commission (CPUC) regulations regarding horizontal clearances for conventional railroads. Current Caltrain passenger cars have steps that allow passengers to ascend from the platforms to the car floors. Special lifts are provided at stations for wheelchair accessibility. If high-speed trains were to share Caltrain platforms under current CPUC regulations, then the rolling stock will need to be equipped with stairs or steps. Other solutions to allow boarding at floor level are possible, but CPUC clearance regulations will need to be addressed.

B. TRANSBAY TERMINAL STATION IN SAN FRANCISCO

Two high-speed tracks with one center platform are assumed for the Transbay Terminal Station Option in San Francisco. This assumption is consistent with current plans for the Tranbay Terminal and environmental review currently being carried out by the Peninsula Commute Joint Power Board and the City and County of San Francisco. The number of tracks and platforms at this location are constrained by the size of the Transbay Terminal site and the need for both high-speed train and Caltrain tracks and platforms within the proposed new terminal. Additionally, the assumed High-speed train platform lengths for the Transbay Terminal Station would be 850 feet. This is again due to site size constraints at the new terminal.

2.2 EVALUATION METHODOLOGY

As listed in Table 2.2-1, a number of key evaluation objectives and criteria were developed based on previous studies with enhancements that reflect the Authority's high-speed train performance goals and criteria described in Task 1.5.2. These objectives and criteria have been applied in the screening of high-speed train alignment and station options developed as part of this process. Each of the evaluation criteria is discussed in Chapter 4.0, Alignment and Station Evaluation.

Table 2.2-1
High-Speed Train Alignment/Station Evaluation Objectives and Criteria

OBJECTIVE	CRITERIA
MAXIMIZE RIDERSHIP/REVENUE POTENTIAL	• TRAVEL TIME • LENGTH • POPULATION/EMPLOYMENT CATCHMENT
MAXIMIZE CONNECTIVITY AND ACCESSIBILITY	• INTERMODAL CONNECTIONS
MINIMIZE OPERATING AND CAPITAL COSTS	• LENGTH • OPERATIONAL ISSUES • CONSTRUCTION ISSUES • CAPITAL COST • RIGHT-OF-WAY ISSUES/COST
MAXIMIZE COMPATIBILITY WITH EXISTING AND PLANNED DEVELOPMENT	• LAND USE COMPATIBILITY AND CONFLICTS • VISUAL QUALITY IMPACTS
MINIMIZE IMPACTS TO NATURAL RESOURCES	• WATER RESOURCES • FLOODPLAIN IMPACTS • THREATENED & ENDANGERED SPECIES IMPACTS
MINIMIZE IMPACTS TO SOCIAL AND ECONOMIC RESOURCES	• ENVIRONMENTAL JUSTICE IMPACTS (DEMOGRAPHICS) • FARMLAND IMPACTS
MINIMIZE IMPACTS TO CULTURAL RESOURCES	• CULTURAL RESOURCES IMPACTS • PARKS & RECREATION/WILDLIFE REFUGE IMPACTS
MAXIMIZE AVOIDANCE OF AREAS WITH GEOLOGIC AND SOILS CONSTRAINTS	• SOILS/SLOPE CONSTRAINTS • SEISMIC CONSTRAINTS
MAXIMIZE AVOIDANCE OF AREAS WITH POTENTIAL HAZARDOUS MATERIALS	• HAZARDOUS MATERIALS/WASTE CONSTRAINTS

The engineering and environmental methodologies and assumptions used in evaluating the high-speed train alignment and station options are described in detail in the Authority's report prepared for Task 1.5.2.

2.2.1 Engineering Evaluation Criteria

The engineering evaluation criteria focus on cost and travel time as primary indicators of engineering viability and ridership potential. Items such as capital costs and travel times have been quantified for each of the alignment and station options considered. Other engineering criteria such as operational, construction, and ROW issues are presented qualitatively.

The evaluation criteria presented are consistent with the criteria applied in the previous corridor evaluation study and are based on accepted engineering practice, the criteria and experiences of other railway and high-speed train systems, and recommendations of VHS and maglev manufacturers.

A. BAY AREA-TO-MERCED CORRIDOR ENGINEERING METHODOLOGY VARIANCES

The Bay Area-to-Merced corridor engineering screening methodology varied from the statewide approach in the following areas:

- ROW cost for railroad property was based on recent purchases in the Bay area and for other similar locations where the UPRR has been willing to sell their ROW.
- The cost for single track aerial structure was assumed to be 60 percent of the standard structure.
- The size of the tunnel bore in the Oakland terminal area was substantially reduced due to anticipated lower speeds and the restrained available ROW. No reduction in cost was made for this reduced tunnel size. Tunnel costs will be refined once detailed geotechnical data are available.

2.2.2 Environmental Evaluation Criteria

The objectives related to the environment and the criteria used for evaluation are consistent with NEPA and CEQA. The environmental constraints and impacts criteria focus on environmental issues that can affect the location or selection of alignments and stations.

To identify potential impacts for the alignments and station locations, a number of readily available resource agency-approved Geographic Information System (GIS)-compatible digital data sources were used along with published information from federal, state, regional, and local planning documents and reports. For evaluation of alignments and stations, ROW widths dictated by engineering requirements were utilized to identify the amount of area within each segment containing certain characteristics. Some environmental issues required using various buffer widths that extended beyond the conceptual ROW for the segments. Where noted, field reconnaissance was required to view on-the-ground conditions and to provide relative values of certain resources.

A. BAY AREA-TO-MERCED CORRIDOR ENVIRONMENTAL METHODOLOGY VARIANCES

For the evaluation of environmental and related alignment and station characteristics, the Bay Area-to-Merced corridor analysis applied the following variations to the statewide approaches.

- The catchment area for employees and population in the Year 2020 was assumed to be equivalent to an airport catchment area rather than a 10-mile radius approach suggested in the statewide evaluation criteria. Based on Bay Area experience, it was noted that people will drive or travel from longer distiances (e.g., from Santa Rosa, Fairfield, Santa Cruz, etc.) to catch an inter-city flight, and the same assumption has be applied for the inter-city high-speed train system.

- Information regarding hazardous materials was not collected. The alignments for the Bay Area-to-Merced corridor are mainly on railroad or highway rights-of-way, and it was assumed that some level of hazardous materials may be present for such corridors, particularly along rail rights-of-way. It was therefore assumed that hazardous material sites would not be a major distinguising factor for this screeing analysis.

- An affirmative search was not performed for archeological nor historic architecture sites along the alignments. When known, however, historic sites were identifed.

- Soils/geology/seismic information was not evaluated for station sites. It was assumed that high-speed train alignments and stations designs will be based on local soils and geology information and to withstand maximum credible earthquakes.

3.0 ALIGNMENT AND STATION DEFINITION

This section describes alignments and stations that were previously studied for high-speed train service by the High-speed Rail Commission or the current High-Speed Rail Authority. Alignments previously studied but since withdrawn from consideration are described first in Section 3.1. Reasons for their withdrawal are provided. Additional alignments that were identified during the screening process but also withdrawn from consideration are identified in Section 3.2, along with the reasons for their withdrawal.

Alignments that were previously evaluated and that have been reevaluated in this screening analysis include the Caltrain corridor on the Peninsula from San Jose to San Francisco, and the Mulford line in the East Bay. These alignments are described in detail in Section 3.3, along with descriptions of all of the alignments and stations that are evaluated in Section 4 of this screening report.

3.1 ALIGNMENTS PREVIOUSLY REVIEWED BY HIGH-SPEED RAIL COMMISSION AND AUTHORITY BUT WITHDRAWN FROM CURRENT CONSIDERATION

Three alignments were previously reviewed by the High-Speed Rail Commission and Authority but have since been withdrawn from consideration: (1) Altamont Pass, and (2) Panoche Pass, and (3) I-80 corridor from Oakland to Sacramento. The I-80 corridor may be reevaluated at a future date as a possible extension of a baseline high-speed train system.

3.1.1 Altamont Pass Alignment

One Alignment evaluated in prior studies would pass from the San Joaquin Valley over the Altamont Pass into the Bay Area. For this Altamont Pass alignment, individual high-speed trains would not be able to serve San Jose, San Francisco, and Oakland. An Altamont alignment would require incoming trains to travel to only one of these three destinations. Consequently, service to the Bay Area would be compromised, and total ridership would be lower for an Altamont Pass alignment as compared to the Pacheco Pass Alignment.

The HSRA staff analysis, as summarized in the July 14, 2000 *Revised Staff Recommendations for VHS Route Adoption*, recommended the Pacheco Pass rather than the Altamont Pass alignment for the reasons identified above. The analysis noted that significant trade-offs exist between the Altamont and Pacheco Pass alignments. While the Pacheco Pass Alignment was previously estimated to be approximately $2 billion

more costly than an Altamont Alignment because of its longer length, a Pacheco Pass alignment was forecast to have higher ridership and revenue potential from the Central Valley to San Francisco (See Table 3.1-1). Using Year 2015 forecasts, the Pacheco Pass Alignment is estimated to have 1.1 million more riders per year and $56 million more in annual revenues than the Altamont Pass Alignment.

Table 3.1- 1
Annual Ridership and Revenue for High Speed Trains
Pacheco and Altamont Pass VHS Alignments (millions)

Alignment	Bay Area Northern Terminus		
	San Francisco	Oakland	Both*
Pacheco Pass			
Riders	21.12	20.49	21.10
Revenue	$744	$725	$746
Altamont Pass			
Riders	20.02	18.95	
Revenue	$688	$657	

*Ridership via Pacheco Pass to San Francisco and Oakland is shown without adding additional trains, i.e., SF and Oakland would each be served with half as many trains in comparison to a terminus at either SF or Oakland. Via the Altamont Pass, however, it is not possible to serve both San Francisco and Oakland along with San Jose.

Source: *Final Report, California High-Speed Rail Corridor Evaluation*, HSR-98004, December 30, 1999.

These two mountain passes also differ in how they would serve Central Valley and Bay Area populations. The Altamont Pass would offer superior service to the Bay Area from the fast growing San Joaquin County area and would provide faster travel times between Sacramento and San Jose or San Francisco. This is the reason this alignment is favored by some Central Valley leaders. An express train traveling between Sacramento and San Jose would take 47 minutes via the Altamont Pass compared to 82 minutes via the Pacheco Pass.

Although the Altamont Pass would provide a more direct link between San Joaquin and Stanislaus counties and the Bay Area population centers, this corridor represents a relatively short distance market with ridership characteristics more fitting a commute corridor than an intercity corridor. The distance between the SR-99 Junction and the San Jose high-speed station would be 66 miles (89 miles to San Francisco). Stanislaus and San Joaquin counties are working with Contra Costa, Alameda and Santa Clara counties on a cooperative transportation planning approach to serve commuters living in the northern Central Valley and working in Southern Alameda county and the Silicon Valley.

Compared to the Altamont Pass, the Pacheco Pass Alignment would reduce travel times between Los Angeles and San Jose by at least 10 minutes (See Table 3.1-2).

However, the greatest benefit of the Pacheco Pass is that all trains would pass through San Jose, regardless of whether San Francisco, Oakland, or both were served. Therefore, from an operational perspective, the Pacheco Pass Alignment would be superior alignments for serving the largest Bay Area markets. The Altamont Pass Alignment would require the system to split at Newark/Fremont to serve either San Jose or San Francisco (or Oakland). This means that only some trains passing through the Altamont Pass from Los Angeles would go to San Francisco, some to Oakland, and some to San Jose. The Pacheco Pass therefore would have superior frequencies of service to the Bay Area and would be less costly and easier to operate.

Table 3.1-2
VHS Travel Time to the Bay Area from Los Angeles
Compared for Pacheco and Altamont Pass Alignments (minutes)

Alignment	VHS Express Travel Time from Los Angeles to:	
	San Jose	San Francisco
Pacheco Pass	122	150
Altamont Pass	132	153

Source: *Final Report, California High-Speed Rail Corridor Evaluation*, HSR-98004, December 30, 1999.

For the Pacheco Pass Alignment, the number of annual riders to San Jose in the Year 2015 is projected to be 3.3 million, with 5.7 million riders using the downtown San Francisco Station. In contrast, operations under the Altamont Pass Alignment would cut service levels by half to each destination due to the split at Newark/Fremont. Moreover, travel times to San Jose from Los Angeles via Altamont would increase by 10 minutes. As a result, system ridership would drop by 1.1 million per year (See Table 3.1-1).

Another negative aspect of the Altamont Route is that it would require building a new bridge across the environmentally sensitive San Francisco Bay for service to San Francisco.

3.1.2 Panoche Pass Alignment

A Panoche Pass Alignment was also reviewed in prior high-speed train studies. This pass is 35-40 miles south of the Pacheco Pass. A Panoche Pass Alignment would be more expensive and would have lower ridership than the Pacheco Pass Alignment. Compared with the Pacheco Pass Alignment, the Panoche Pass Alignment would cost about $0.5 billion additional for just the mountain pass segment alone.[8] The difference in total system cost with respect to the Pacheco Pass Alignment would be even higher, given the added distance through the Panoche Pass. Although service from Los Angeles to the Bay Area via the Panoche Pass would be slightly faster than via the Pacheco Pass, ridership would be lower by an estimated 300,000 riders per year because the Merced area would not be as well served. In addition, the Panoche Pass Alignment would reduce the high-speed train service provided to the northern portion of the Central Valley (e.g., Stockton and Sacramento), in that trips from northern California to the Bay Area would take substantially longer via this pass.

3.1.3 I-80 Corridor from Oakland to Sacramento

Previous High-speed Rail Commission studies considered the I-80 corridor to link the San Francisco Bay Area and Sacramento. These studies concluded that the existing "Capitol" rail service should be improved to speeds of up to 110 mph and would serve as a feeder system to the statewide high-speed train system. The existing rail corridor between Oakland and Benicia has major curve and speed constraints and cannot be upgraded to achieve high speeds without major capital cost implications. The distance between Oakland and Sacramento is relatively short when viewed as an intercity market, and high-speeds are not needed to serve this market. However, a trip from Sacramento to Los Angeles via the I-80 corridor would be approximately 1½ hours longer through the San Francisco Bay Area than a trip from Sacramento to Los Angeles through the Central Valley. Capitol Corridor rail service currently exists between San Francisco and Sacramento, and operating and rail improvements are anticipated for

[8] Intercity High-Speed Rail Commission, *High-Speed Rail Summary Report and Action Plan, Final Report*, December 1966, Table 8.5.

this service. This alignment could be considered as a potential future extension of the high-speed train system but is not proposed to be included in the initial baseline system or in the Program EIS/EIR.

3.2 Alignment Options Identified During Preliminary Screening but not Proposed for Inclusion in the Program EIS/EIR

In addition to the alignments previously studied by the High-Speed Rail Commission and Authority described above, several alignments were identified early in the screening process but were subsequently withdrawn from further evaluation. These alignments along with the reasons for their withdrawal are discussed below.

3.2.1 San Francisco Peninsula Route 280

For the San Francisco Peninsula between San Jose and San Francisco, the U.S. 101 and Caltrain corridors have been evaluated in this screening report. These alignments are described in Section 3.3 below. The only other existing linear corridor between San Francisco and San Jose is Route 280, which has been withdrawn from additional consideration.

The freeway is fully developed through most of Santa Clara County, but has some open space either in the median or adjacent to the roadway though the northern part of Santa Clara County and through San Mateo County. The portion within the City and County of San Francisco is fully developed. Depending on the location, several configurations could be possible. A separate guideway on elevated structure either in the median or to one side of the roadway would be needed in developed areas. In the undeveloped areas, a separate at-grade guideway alongside the freeway may be possible. The terrain is hilly, and considerable earthwork or retaining walls likely would be needed. The areas through Palo Alto and Woodside are nature preserves, so encroachment outside the freeway ROW would have potential adverse impacts in these areas.

The freeway passes through the mountains between the Pacific Ocean and the San Francisco Bay. There are many curves that would restrict speed for high-speed train service. Vertical alignment may also be incompatible in some areas, both in terms of grades for VHS rail, and for vertical curvature for both VHS and maglev. An alignment along the 280 Freeway would encounter difficulties at freeway interchanges with routes 17 (580), 85, and 92 as described below for the U.S. 101 corridor.

The I-280 corridor would not allow a convenient connection to San Francisco International Airport from the south. The alignment would have to leave the freeway corridor and pass through Hillsborough and Burlingame to provide access the airport. To the north, the guideway would presumably follow the U.S. 101 freeway, rather than returning to the 280 freeway.

Connecting the San Jose Diridon Station with a route following the I-280 Freeway would require a guideway passing through developed portions of downtown San Jose. Any aerial structure alignment would involve considerable property acquisition, and a tunnel configuration would be very costly. For these reasons, Route 280 has not been further evaluated in this screening process.

3.2.2 Former SPRR (San Jose to Warm Springs)

The former SPRR line is in the middle of the three existing rail lines in Santa Clara County. It is heavily used in the northern section by the UPRR for servicing the NUMI automobile plant and is also used to provide freight access to the Caltrain corridor as an alternative to the Mulford line. The northern portion is approximately 60 feet wide and the southern portion of this line is extremely narrow – 30 feet – and passes through residential areas, including new apartment complexes directly adjacent to the ROW.

Purchasing the ROW necessary to widen the corridor to 100 feet and providing full grade separation would be prohibitive in terms of capital cost and impacts to commercial, industrial and residential properties. This Alignment has been eliminated from further consideration as a high-speed train corridor.

3.2.3 Former WPRR (San Jose to Warm Springs)

The former WPRR line is the furthest east of the three rail lines in Santa Clara County and is the least used by the UPRR. It is under consideration by the UPRR to be sold to Santa Clara Valley Transportation Authority (VTA) for transit use and would therefore not be a viable alignment for high-speed trains for most of the length except for a small portion near the future BART Warm Springs station. (The section between Fremont and San Leandro is discussed later in this report as part of the I-880/Hayward Branch Alignment.) The connection from the WPRR to Diridon Station would be at very slow speeds through residential areas via aerial structure and would require entering and leaving Diridon Station from the south instead of a through move to the north. Purchasing the ROW necessary to widen the corridor sufficiently for all planned uses and providing full grade separation would be prohibitive in terms of capital cost and impacts to commercial, industrial and residential properties. This Alignment has been eliminated from further consideration as a high-speed train corridor.

3.2.4 I-280/I-680 Highway Corridor (San Jose to Fremont)

The I-280 is an older section with two major four level intersections that would require extremely high structures for high-speed trains. It would also require that trains enter and leave Diridon Station from the south instead of a through move to the north. The I-680 portion from San Jose to Warm Springs is a modern highway with adequate median width for a potential aerial solution in the median. This line is approximately two miles longer than the I-880 corridor. From Warm Springs it would follow the I-880/Hayward Branch alignment or WPRR alignments. The extremely high structures over the interchanges along I-280 and the additional length over the I-880 route provide no additional benefit over the I-880 alignments for the same corridor. The additional requirement to reverse trains out of Diridon Station to head towards Oakland eliminates this Alignment from further consideration as a high-speed train corridor.

3.2.5 Bay Crossing From San Francisco to Oakland

During the scoping process, the public has identified a bay crossing via a tube or on the Bay Bridge to carry high-speed and/or commuter trains as an option to connect San Francisco and Oakland. The cities of San Francisco and Oakland have also identified this crossing as an important option. This option could be considered as a potential future extension of the currently defined high-speed train system, but it is not proposed to be included in the initial baseline system or the Program EIS/EIR. Based on current estimates, it appears to be less costly to provide high-speed train service along both the Peninsula and East Bay than to construct a bay crossing in a tube or by adding rail on the San Francisco-Oakland Bay Bridge (without taking traffic lanes). Taking traffic lanes on the bridge for a commuter/high-speed train system does not appear to be practical. The High-Speed Rail Authority anticipates participating in the Metropolitan Transportation Commission's current San Francisco Bay Crossing Study that will consider high-speed trains.

3.3 ALIGNMENTS AND STATIONS CONSIDERED IN SCREENING PROCESS

- The Bay Area-to-Merced corridor has been divided into three segments for analysis purposes. These segments include:

    - Merced-to-San Jose,
    - San Jose-to-San Francisco, and
    - San Jose-to-Oakland.

Alignment and station location options within these segments are described below and illustrated in Figure 3.3-1.

3.3.1 Merced-to-San Jose Segment

The following alignments and stations were evaluated for the Merced-to-San Jose Segment. In this segment, all alignments would be on an exclusive guideway with separate tracks for high-speed trains and would connect to the Sacramento-to-Bakersfield high-speed train corridor.

- **Pacheco Pass/Gilroy/Caltrain Alignment**: This alignment would extend from Merced through the San Joaquin Valley and Pacheco Pass and then north along the Caltrain/Union Pacific Railroad (UPRR) rail corridor. Station options include Los Banos (near I-5) in the San Joaquin Valley, Gilroy (near the existing Caltrain Station), and the existing San Jose (Diridon) Station.

- **Pacheco Pass/Caltrain/Morgan Hill Alignment**: This alignment would extend from Merced through the San Joaquin Valley and Pacheco Pass and then north along the Caltrain/UPRR rail corridor. Station options include Los Banos (near I-5) in the San Joaquin Valley, Morgan Hill (near the existing Caltrain Station), and the existing San Jose (Diridon) Station.

- **Pacheco Pass/East of 101/Morgan Hill/Caltrain Alignment**: This alignment would extend from Merced through the San Joaquin Valley and Pacheco Pass, travel north in the U.S. 101 corridor, and then north along the Caltrain/UPRR rail corridor. Station options include Los Banos (near I-5) in the San Joaquin Valley, Morgan Hill (next to U.S. 101), and the existing San Jose (Diridon) Station.

- **Pacheco Pass/Foothills/Morgan Hill/Caltrain Alignment**: This alignment would extend from Merced through the San Joaquin Valley and Pacheco Pass, travel north in the foothills east of U.S. 101, and then north along the Caltrain/UPRR rail corridor. Station options include Los Banos (near I-5) in the San Joaquin Valley, Morgan Hill (in the foothills), and the existing San Jose (Diridon) Station.

- **Direct Tunnel Northern Alignment**: This alignment would pass from Merced (near Castle Air Force Base) through the San Joaquin Valley to a long (31-mile – 49.6 km) tunnel and onto the Caltrain/UPRR rail corridor north of I-85 and would have a station at the existing San Jose (Diridon) Station.

- **Direct Tunnel Southern Alignment**: This alignment would pass from Merced (at a Merced Municipal Airport Station) through the San Joaquin Valley to a long (31-mile – 49.6 km) tunnel and onto the Caltrain/UPRR rail corridor north of I-85 and would have a station at the existing San Jose (Diridon) Station.

Figure 3.3-2 shows the alignments and stations for the Merced-to-San Jose Segment. Subsegments for each of the alignments are described below.

Figure 3.3-1: Alignments and Stations for the Bay Area-to-Merced Corridor

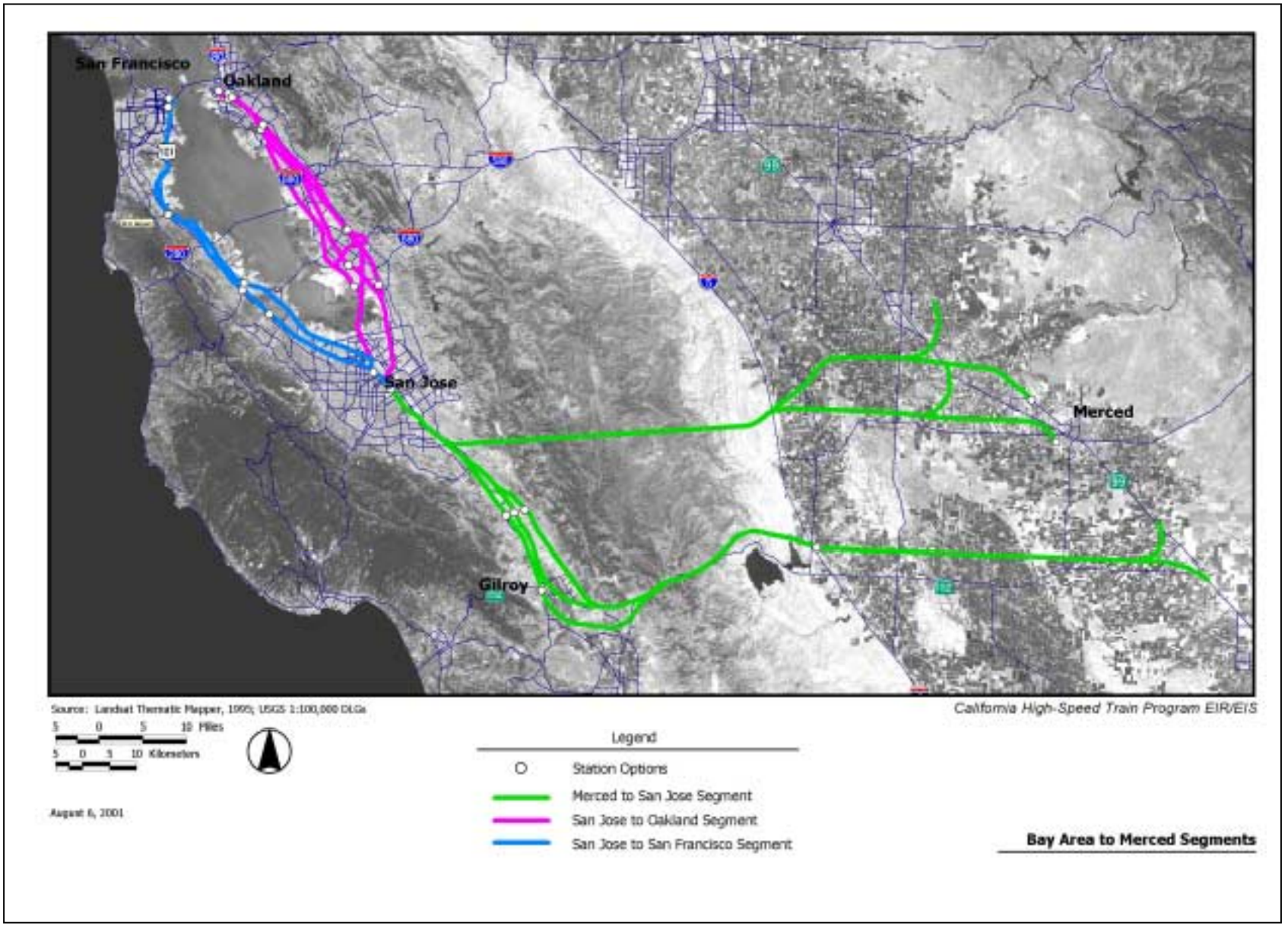
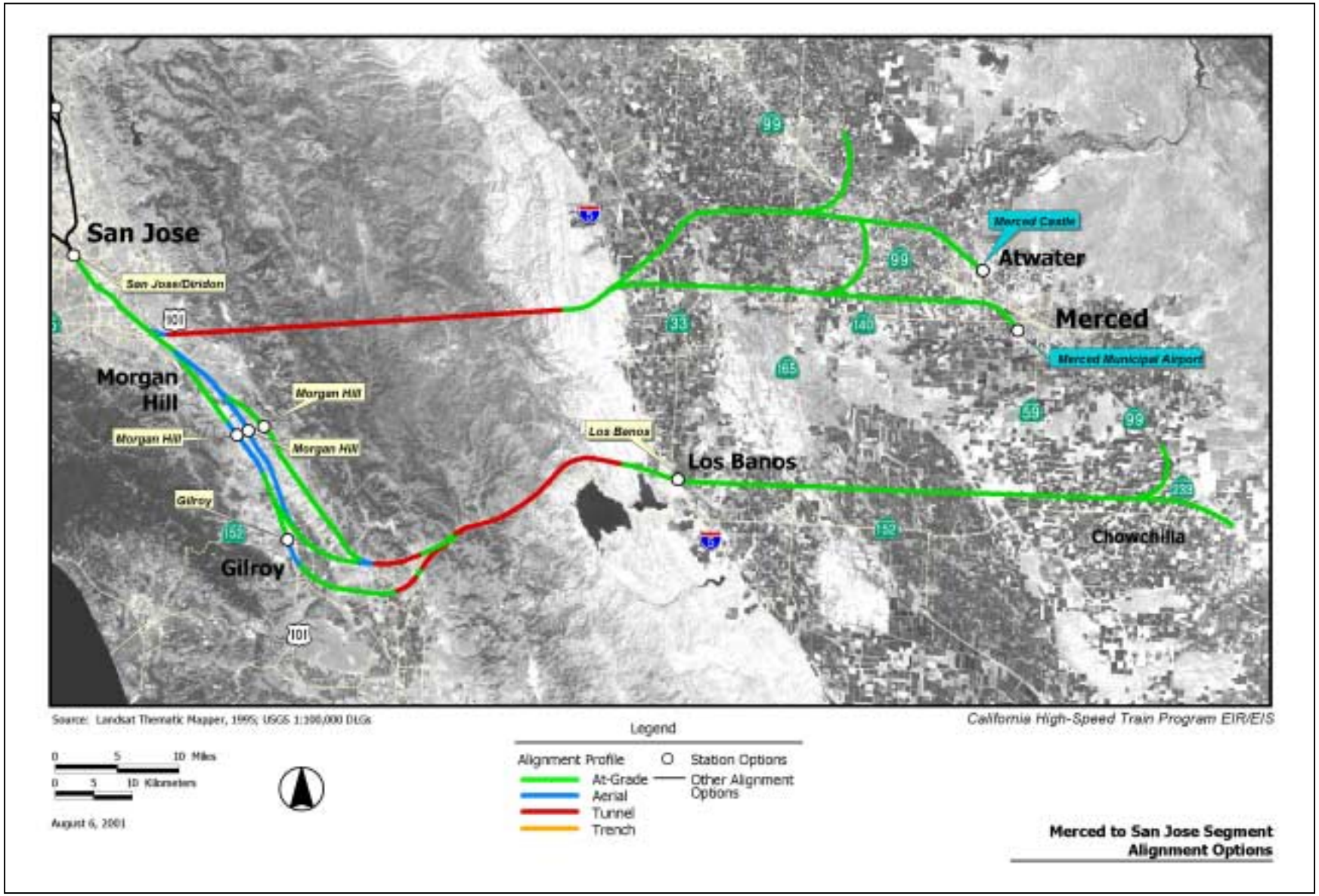


Figure 3.3-2: Alignments and Stations for the Merced to San Jose Sement



A. MERCED TO PACHECO PASS SUBSEGMENT

The previously identified high-speed train alignment for the Central Valley utilizes the "west of 99" route as a basis of design and connects to the Central Valley alignment in the Chowchilla area. The alignment would be within the corridor identified in the *California High-Speed Train Business Plan* (June 2000).

For the Merced to Pacheco Pass subsegment, the alignment would be along Henry Miller Avenue and Washington Road from Merced to a location near I-5, north of Los Banos. This route would be at-grade, wherever possible, but will require some short aerial segments. The route does not follow any existing railroad tracks, therefore no shared use of track is proposed. A station would be located near the I-5 Highway and Los Banos, with appropriate parking facilities. The alignment would need to cross open farmlands and several drainages, rivers and wetlands, and it would pass near or through wildlife preserve areas. Overall, however, the alignment would have few physical restrictions.

This subsegment would begin at the Central Valley line near the SR-152/SR-99 interchange in a four-track configuration. Trains would be able to pass through this section and head to either the Bay area at 200 mph or to Sacramento at 150 mph, utilizing high-speed turnouts. The route would be on embankment throughout this section, with bridge structures over the local roads, and drainages. The track from Sacramento heading south would be in an aerial section passing over the double track embankment section to and from the Bay Area.

The route would continue on embankment and turn west via a 200-mph curve to an alignment parallel to Avenue 24 and Jefferson Road. The route would cross two land sections at a diagonal, resulting in numerous parcel splits. This portion is rural with few residences along the roads. The route is proposed to be alongside the roadway to minimize disruption to agricultural fields. The route would continue west in an at-grade configuration passing over the San Joaquin River, and numerous drainages and wetlands to an alignment parallel to Henry Miller Avenue. Crossroads are proposed at approximate two-mile intervals in this section.

After passing over the UPRR corridor near Volta, the route would be between the San Luis Wasteway and Henry Miller Avenue, leading to a Los Banos Station site near Cherokee Road and the Main Canal approximately 1½ miles to the east of I-5. The guideway would be four tracks at the station and transition to a two track aerial structure over the outside canal and I-5.

Near the Ash Slough, the route would diverge for the high speed (150 mph) Sacramento to Bay Area connection. The track from the Bay Area to Sacramento would be in an at-grade section passing below the double track embankment section to and from the Bay Area in a subway box. The Sacramento to Bay Area connection would continue across the rural area at a diagonal to the roads and property lines passing to the west of Chowchilla and rejoining the SR-99/UPRR corridor to the north of the Chowchilla River. The Bay Area to Sacramento track would have to pass over the at-grade Sacramento to Los Angeles route on a single-track aerial structure.

A major issue in this subsegment would be construction through the wetland areas. The route is generally at-grade through these areas. However, low aerial structure will be considered to mitigate the environmental impact. The low structure would allow the water to flow freely beneath the guideway. Final structure determination will be made during detail design.

An effort has been made to keep the main route located on existing ROW lines adjacent to or between roadways as much as possible to minimize property impact. Underpasses for separated agricultural land will be provided.

The high-speed curves for the main route to the Bay area from the Central Valley line would bisect approximately two sections south of Chowchilla. One quarter of these sections seems to contain recent development, and the final alignment will need to be reviewed to minimize this impact.

The Sacramento to Bay Area connection would pass across the rural area at a diagonal to the roads and property lines resulting in numerous parcel splits. Extra ROW would need to be purchased to mitigate the impact. Alternatively parcel swaps with adjoining owners could be negotiated to minimize underpasses and parcel splits.

B. PACHECO PASS/GILROY/CALTRAIN SUBSEGMENT

Continuing west from the Merced to Pacheco Pass subsegment, the Pacheco Pass/Gilroy/Caltrain alignment would use the Pacheco Pass to cross the range of hills between the Central Valley and the Bay Area. The alignment would join the existing Caltrain/Amtrak corridor in Gilroy, where it would then continue north to the San Jose (Diridon) Station. The horizontal alignment is basically the same as the Pacheco Pass segment studied in the 2000 corridor evaluation although the vertical profile differs in certain areas. The length of the alignment from I-5 in the Central Valley to Route 85 in South San Jose is approximately 58.5 miles, with roughly 30.8 miles (53 percent) at-grade, 9.3 miles (16 percent) in aerial structure, and 18.4 miles (31 percent) percent in tunnel.

For this subsegment, the high-speed guideway would cross I-5 on an aerial structure and run at grade north of the O'Neill Forebay Dam. The double tracks would split to enter twin tunnel portals north of San Luis Dam near Romero Creek. The approximately 13.5-mile-long twin tunnels would curve around the northern shore of San Luis Reservoir until they align with the Pacheco Pass. The route would exit the tunnels at the east end of the lower Pacheco Creek Valley where they would run at-grade along southwest-trending portion of the Valley floor.

From the Pacheco Creek Valley, the horizontal alignment is basically same as the Pacheco Pass segment studied in the 2000 corridor evaluation that routed the tracks along the southern slopes of the Pacheco Creek Valley. However, for this screening analysis, the overall profile of the route has been evaluated at a lowered in elevation, placing the route in tunnels beneath the slopes. The longer tunnels would reduce possible environmental and construction access problems caused by numerous short tunnels and extensive cut-and-fill segments in hillsides. The lowered profile results in three tunnels: the 13.5-mile tunnel described above plus two short tunnels on either side of the southern end of the Pacheco Creek Valley.

The route would then enter the Santa Clara Valley and run at-grade in a high embankment over the flat valley floor curving south, west, and then north to Gilroy, where the tracks would enter the Caltrain/Amtrak rail corridor just north of Bloomfield Road.

The horizontal alignment and grades for this alignment allow for full-speed operation through the Pacheco Pass. The high-speed train infrastructure will require special seismic provisions to handle displacements and severe shaking from several active faults crossed, including the major Calaveras Fault.

C. PACHECO PASS/CALTRAIN/MORGAN HILL SUBSEGMENT

The Pacheco Pass/Foothills/Morgan Hill subsegment would also pass from the central valley through the Pacheco Pass Valley. It would cross through the Pass and enter Morgan Hill using at-grade construction, tunnels, and aerial structures. It would then use the existing Caltrain/Amtrak rail corridor to San Jose, with a station at Morgan Hill. The length of the

alignment from I-5 west of Los Banos in the Central Valley to Route 85 in South San Jose is about 55.1 miles, with about 26.2 miles (48 percent) at-grade, 10.8 miles (20 percent) aerial, and 18.1 miles (33 percent) in tunnel.

The alignment for this subsegment from I-5 up to the Pacheco Creek Valley would be the same as that for the Pacheco Pass/Gilroy/Caltrain subsegment. Where the Pacheco Creek Valley bends south, the route would cross under a new Highway 152 overpass and enter three-mile-long twin tunnels that would exit onto a mile-long aerial structure just north of the San Felipe Lake. The route would then run at-grade while curving northwest, passing east of Gilroy. South of Leavesley Road, the tracks would ascend to aerial structure to cross U.S. 101 and existing railroad tracks and enter Morgan Hill from the south. A possible Morgan Hill Station site would be located north of Dunne Avenue.

The horizontal alignment and grades for this subsegment allow for full-speed operation through the Pacheco Pass. The high-speed train infrastructure will require special seismic provisions to handle displacements and severe shaking from several active faults crossed, including the major Calaveras Fault.

D. PACHECO PASS/EAST OF 101/MORGAN HILL/CALTRAIN SUBSEGMENT

This subsegment would also use the Pacheco Pass Valley and new tunnels to cross the range of hills between the Central Valley and the Santa Clara Valley. The subsegment is identical to the Pacheco Pass/Gilroy/Caltrain Alignment except that, beginning southeast of Morgan Hill, the route would run roughly parallel to the U.S. 101 on the east side of the freeway. A proposed Morgan Hill Station site is located in the vicinity of Dunne Avenue.

The route would run east of U.S. 101 entirely in aerial structure, through Morgan Hill and across Coyote Creek. The alignment would join the existing Caltrain rail corridor east of Tulare Hill in south San Jose. The length of this alignment from I-5 in the Central Valley to Route 85 in south San Jose would be 55.3 miles, with roughly 17.2 miles (31 percent) at-grade, 20.0 miles (36 percent) in aerial structure, and 18.1 miles (33 percent) in tunnel.

The high-speed train infrastructure will require special seismic provisions to handle displacements and severe shaking from several active faults crossed, including the major Calaveras Fault.

The route would run east of U.S. 101 mostly in aerial structure through Morgan Hill and across Coyote Creek, with a stretch of at-grade with cuts, fills, and retaining walls in the foothills east of Coyote Creek. The route would join the existing Caltrain rail corridor east of Tulare Hill.

E. PACHECO PASS/FOOTHILLS/MORGAN HILL/CALTRAIN SUBSEGMENT

This subsegment would also use the Pacheco Pass Valley and new tunnels to cross the range of hills between the Central Valley and the Santa Clara Valley. The alignment is identical to the Pacheco Pass/Gilroy/Caltrain Alignment except that it would pass through Morgan Hill along the relatively undeveloped foothills below Anderson Lake before joining the U.S. 101 corridor after crossing Coyote Creek. The foothills segment would be largely at-grade with cuts, fills, and retaining walls. A proposed station site is located in the vicinity of Chochrane Avenue. The length of the alignment from I-5 in the Central Valley to the San Jose Station is 54.3 miles, with roughly 28.5 miles (53 percent) at-grade, 7.7 miles (14 percent) in aerial structure and 18.1 miles (33 percent) in tunnel.

The high-speed train infrastructure will require special seismic provisions to handle displacements and severe shaking from several active faults crossed, including the major Calaveras Fault that lies very close to the foothills portion of the subsegment.

F. MORGAN HILL (CALTRAIN) TO SAN JOSE SUBSEGMENT

The southern portion of this subsegment would follow the UPRR and Caltrain alignment alongside Monterey Highway. The alignment would be within the corridor identified in the *California High-Speed Train Business Plan* (June 2000). This portion of the route would be at-grade and would require the reconstruction of the existing rail corridor and highway corridor. The high-speed train alignment would be located between the Caltrain tracks and the UPRR tracks with adequate clearances from both. No shared use of track is proposed, although with proper compatible equipment, Caltrain could use the express tracks to by-pass some stations for express service. Caltrain would have four intermediate stations along this route. High-speed trains would not stop at these locations. Caltrain and high-speed trains would stop at Diridon Station with all high-speed trains stopping at this location.

Agricultural ROW would have to be purchased to the east of the Monterey highway corridor to allow for the corridor expansion. Additional residential property would have to be purchased in the central San Jose area near the I-280/SR-87 interchange. All existing grade crossings would either be closed or grade separated.

All existing highway grade crossings would be grade separated or closed in this entire subsegment. This would improve safety and reduce the noise factor due to the required bells and whistles. The high-speed route would be within the Caltrain ROW between the two Caltrain tracks along the entire length of the Monterey Highway corridor. This would allow the high-speed trains to pass through the Caltrain stations without affecting the passengers on the side platforms. A separate UPRR corridor is assumed to the east of the Caltrain tracks (twenty-foot separation), with allowances for a future second UP track. Monterey Highway is assumed to be relocated to the east. The design speed throughout the Monterey Highway corridor is 150 mph. The design speed would then drop proportionally to 0 mph at the San Jose (Diridon) Station, since all trains would stop there.

The existing ROW would need to be expanded by approximately 25 to 70 feet from Cochran Road to Bailey Avenue. The future Caltrain station in the vicinity of Bailey Avenue would require the purchase of additional ROW on both sides of the corridor, nine feet to the west and sixty feet to the east. The UPRR tracks would need to be relocated to the east an additional 11 feet to allow for the side platforms. The high-speed train alignment from Emadu Avenue to Ford Road would be similar to area between Cochran Road and Bailey Avenue and would require the purchase of 10 to 35 feet of ROW to the east. The existing land to the east is used as agricultural land.

The future Caltrain station at Blossom Hill would require the purchase of additional ROW on both sides of the corridor, 9 feet to the west and 35 feet to the east. The UPRR tracks would need to be relocated to the east an additional 11 feet to allow for the side platforms.

From Blossom Hill Road to Senter Road, Monterey Highway would be narrowed at the suggestion by the City of San Jose to a four-lane section with a median. This would allow Caltrain, high-speed train alignment, the UPRR, and Monterey Highway to exist within the existing ROW. A landscape strip of approximately 19 feet has been assumed between the UPRR and Monterey highway.

Between Senter Road and Capitol Expressway, Monterey highway would remain at six lanes, and five feet of additional ROW would need to be purchased to the east. The landscape strip would have to be eliminated.

Location of a Caltrain station at Capitol Expressway would require that additional ROW on both sides of the corridor, 9 feet to the west and 15 feet to the east be acquired for the high-speed train alignment. The UPRR tracks would need to be relocated to the east an additional 11 feet to allow for the side platforms.

From Monterey Highway to Almaden Expressway, an additional 65 feet of ROW would be required. This ROW could be purchased either to the east or west, depending on the overall impact. This area is in an industrial quarry operation and residential neighborhoods.

The alignment from Almaden Expressway to SR-87 would be on aerial structure on the side of the highway and to the east of the Caltrain/UPRR corridor. The structure would overhang the highway, bikeway and tracks with sufficient clearance to not obstruct operations. It would cross SR-87 on curved aerial structure.

From SR-87 to I-280, the alignment would pass through a residential neighborhood adjacent to the Caltrain corridor in an at-grade embankment configuration. Possible acquisition of some properties may be necessary in this area. The present Caltrain/UPRR corridor is fully grade separated, and the high-speed train alignment would follow the existing facilities.

The high-speed alignment would cross I-280 on aerial structure and remain in this configuration to pass over Auzerais Avenue, the West San Carlos Street structure, the UPRR Vasona freight operations, and the Caltrain tracks. This configuration would position high-speed train alignment at the San Jose (Diridon) Station two levels above the Caltrain platforms. The AMTRAK, ACE, Caltrain, and VTA platforms would be at grade level. A new passenger concourse level would be constructed directly above the platforms to serve as access to all the platforms at ground level and the high-speed train platforms one level above the concourse. Two platforms with four tracks are proposed initially, with a potential for another platform and two tracks in the future. All trains to San Francisco and Oakland would stop at this location offering direct transfer capability to AMTRAK Starlight service, AMTRAK Capital Corridor, ACE, Caltrain, VTA Vasona LRT, and possible future BART service. Busses, taxis and other local van service would be available curbside outside the terminal. The San Jose (Diridon) Station could serve as a temporary terminal for high-speed train service while the line is extended to San Francisco and Oakland.

G. DIRECT TUNNEL SUBSEGMENT – MERCED TO I-5 SOUTH SUBSEGMENT (FROM MERCED AIRPORT)

This subsegment begins at the high-speed train station at the Merced Municipal Airport in a four-track configuration. All trains from the south would be able to stop at this station location. The route would emerge from this station in a straight line to allow for special trackwork. Express trains would be able to pass through the station and head to either the Bay area at 200 mph or to Sacramento at 150 mph utilizing a high-speed turnout. Trains stopping at the station would also be able to proceed to both destinations. The route would be on embankment throughout this section with bridge structures over the local roads, SR-140, sloughs and canals. The track from Sacramento would be on single-track aerial structure passing over the double track embankment section to and from the Bay Area. The Sacramento route would remain on separate aerial structures passing over Bear Creek and Black Rascal Creek and rejoin the SR-99/UPRR corridor prior to Buhach Road south of Atwater in an at-grade configuration.

The subsegment would continue on embankment and aerial structure over the same creeks and turn west via a 200 mph curve to an alignment half way between Rose Avenue to the north and White Crane Road to the south. This area is semi rural with numerous residences along the roads. The alignment would ideally be located on the ROW line between these roads for each of the residential properties. This should be verified and refined during later design. The route would continue west in an at-grade configuration passing over numerous drainages and local roads. The roads are approximately at one-mile intervals at the section lines.

Near Lake Honda, the route would pass over some wetlands and provide for a high speed (150 mph) Sacramento-to-Bay Area connection. The track from the Bay Area to Sacramento would be in a single-track subway box passing under the double track at-grade section to and from the Bay Area. The Sacramento-to-Bay Area connection would continue across the rural area at a diagonal to the roads and property lines passing to the west of Livingston and rejoining the SR-99/UPRR corridor to the north of the Merced River. The track from the Bay Area to Sacramento would be on single-track aerial structure passing over the double track at-grade section from Los Angeles to Sacramento. The track from Sacramento to the Bay area would be at-grade.

The Bay Area route would continue on embankment to the south of Stevinson and a local landing strip that would have to be closed or relocated. This area is semi rural with numerous residences along the roadway frontages. The crossroads are at approximate one half-mile intervals. The route would pass over a wetlands area, duck ponds, the San Joaquin River, numerous sloughs, creeks, and the Newman Waterway.

The alignment would continue to the north of Newman, crossing over SR-33, the railroad tracks into Newman, the Main Canal, the Delta Mendota Canal, and the I-5 Highway into the valley of the Oristimba Creek to the portal of the direct tunnel approximately five miles west of I-5.

The major issues in this subsegment would be construction through wetland areas. The route is generally at-grade through these areas. However, low aerial structure will be considered to mitigate the environmental impacts. The low structure would allow the water to flow freely beneath the guideway. Final structure determination will be made during detail design. An effort has been made to locate the main route on existing ROW lines between roadways to minimize property impacts. Underpasses for separated agricultural land would be provided.

The Sacramento to Bay Area connection would pass across the rural area at a diagonal to the roads and property lines resulting in numerous parcel splits. Extra ROW would need to be purchased to mitigate the impact. Alternatively parcel swaps with adjoining owners could be negotiated to minimize underpasses and parcel splits.

H. DIRECT TUNNEL SUBSEGMENT - MERCED TO I-5 NORTH SUBSEGMENT (FROM MERCED CASTLE AIR FORCE BASE STATION)

This subsegment is similar to the Merced to I-5 South subsegment from Merced Airport but would be generally six to seven miles further north due to the location of the Castle Air Force Base high-speed train station in Merced. The station is located on the BNSF railroad corridor at the Buhach/Belleview Road intersection near the Air Force base. The station would be in a four-track configuration. The trackwork and structure/embankment configuration is similar to the one described above for the Direct Tunnel Southern Subsegment. Trains would pass through this section and head to either the Bay area at 200 mph or to Sacramento at 150 mph utilizing a high-speed turnout. The line would continue along the rail corridor until north of Winton, where it would curve to the west across agricultural land to an alignment half way between August Road to the north and American Avenue to the south. The route would cross the Merced River and the

SR-99/UPRR corridor to an at-grade section passing over the local roads located generally at section lines.

The Sacramento-to-Bay Area connection would be located near Hilamar and SR-165. The track from the Bay Area to Sacramento would be in an at-grade section passing below the double track embankment section to and from the Bay Area in a subway box. It would continue across the rural area at a diagonal to the roads and property lines, passing to the northwest of Delhi and rejoin the BNSF corridor near the Vincent Road crossing. The track from the Bay Area to Sacramento would be on single-track aerial structure passing over the double track at-grade section to Los Angeles from Sacramento. The route would pass over the San Joaquin River and numerous drainages and turn to the southwest following J. D. Crow road to the SR-33/UPRR corridor. After passing over the highway/rail corridor and the Main Canal, the route would generally follow Orestimba Creek. It would cross three sections at a diagonal to pass over the Delta Mendota Canal, I-5, and the California Aqueduct to the portal of the direct tunnel, similar to the route described above for the Direct Tunnel Southern Alignment.

I. DIRECT TUNNEL SUBSEGMENT -- I-5 TO SAN JOSE – (FOR BOTH NORTHERN AND SOUTHERN)

This subsegment would include a direct tunnel from a portal approximately five miles west of I-5 to a portal just to the east of the interchange of U.S. 101 and SR-85. The total length of this alignment from I-5 near the town of Newman in the Central Valley to Downtown San Jose would be about 38.8 miles with about 31 miles (80 percent) in tunnel, 5.6 miles (14 percent) at-grade, and 2.2 miles (6 percent) in aerial structure.

For this subsegment, the high-speed route would cross I-5 freeway north of Newman on aerial structure. The double tracks wind at-grade up the Ortigalita Valley and then split to enter twin tunnel portals at the west end of the valley. The route would proceed west below the hills south of Mount Hamilton in twin 31-mile-long tunnels. Such tunnels would be among the longest tunnels in the world.

The route would exit the western portals near the SR-85/U.S. 101 interchange in two aerial structures that would merge into a single aerial structure, follow a portion of the SR-85 ROW, and then merge into the existing Caltrain/Amtrak corridor. The high-speed train infrastructure will require special seismic provisions to handle displacements and severe shaking from several active faults crossed, including the major Calaveras Fault.

3.3.2 San Jose-to-San Francisco Segment

The following alignments and stations were evaluated for the San Jose-to-San Francisco Segment:

- **U.S. 101 Alignment to Transbay Terminal:** This alignment would be on an exclusive guideway in the U.S. 101 corridor. Station options include an optional station in Santa Clara, a station in Redwood City, a station in Millbrae (near the San Francisco International Airport), and a station in the lower level of the proposed new Transbay Terminal in San Francisco.

- **U.S. 101 Alignment to 4th and King**: This alignment would be on an exclusive guideway in the U.S. 101 corridor. Station options include an optional station in Santa Clara, a station in Redwood City, a station in Millbrae (near the San Francisco International Airport), and a station over the Caltrain yard/station at 4th and King streets in San Francisco.

- **Caltrain Corridor (Exclusive Guideway) to Transbay Terminal**: This alignment would be on an exclusive guideway within the Caltrain corridor. Station options include an optional station in Santa Clara, a station in either Redwood City or Palo Alto, a station in Millbrae (near the

San Francisco International Airport), and a station in the lower level of the proposed new Transbay Terminal in San Francisco.

- **Caltrain Corridor (Exclusive Guideway) to 4th and King:** This alignment would be on an exclusive guideway within the Caltrain corridor. Station options include an optional station in Santa Clara, a station in either Redwood City or Palo Alto, a station in Millbrae (near the San Francisco International Airport), and a station over the Caltrain yard/station at 4th and King streets in San Francisco.

- **Caltrain Corridor (Shared-track with Caltrain) – Basic Service Option**: This option assumes that high-speed trains would share tracks with Caltrain commuter trains in the Caltrain corridor. The entire alignment would be grade-separated, but not all Caltrain stations would include four tracks. Station options include an optional station in Santa Clara, a station in either Redwood City or Palo Alto, a station in Millbrae (near the San Francisco International Airport), a station at 4th and King streets, and a station in the lower level of the proposed new Transbay Terminal in San Francisco.

- **Caltrain Corridor (Shared-track with Caltrain) – Four-track Station Option:** This option assumes that high-speed trains would share tracks with Caltrain commuter trains. The entire alignment would be grade-separated, and all Caltrain stations would either have four tracks or by-pass tracks. Station options include an optional station at Santa Clara, a station in either Redwood City or Palo Alto, a station in Millbrae (near the San Francisco International Airport), a station at 4th and King streets, and a station in the lower level of the proposed new Transbay Terminal in San Francisco.

Figure 3.3-3 shows the alignments and stations for the San Jose-to-San Francisco Segment. Subsegments for each of the alignments are described below.

A. CALTRAIN CORRIDOR OPTIONS

Three options are evaluated for the Caltrain corridor running along the Peninsula from San Jose to San Francisco:

- An exclusive guideway solely for high-speed trains (either VHS or maglev) along the Caltrain corridor,

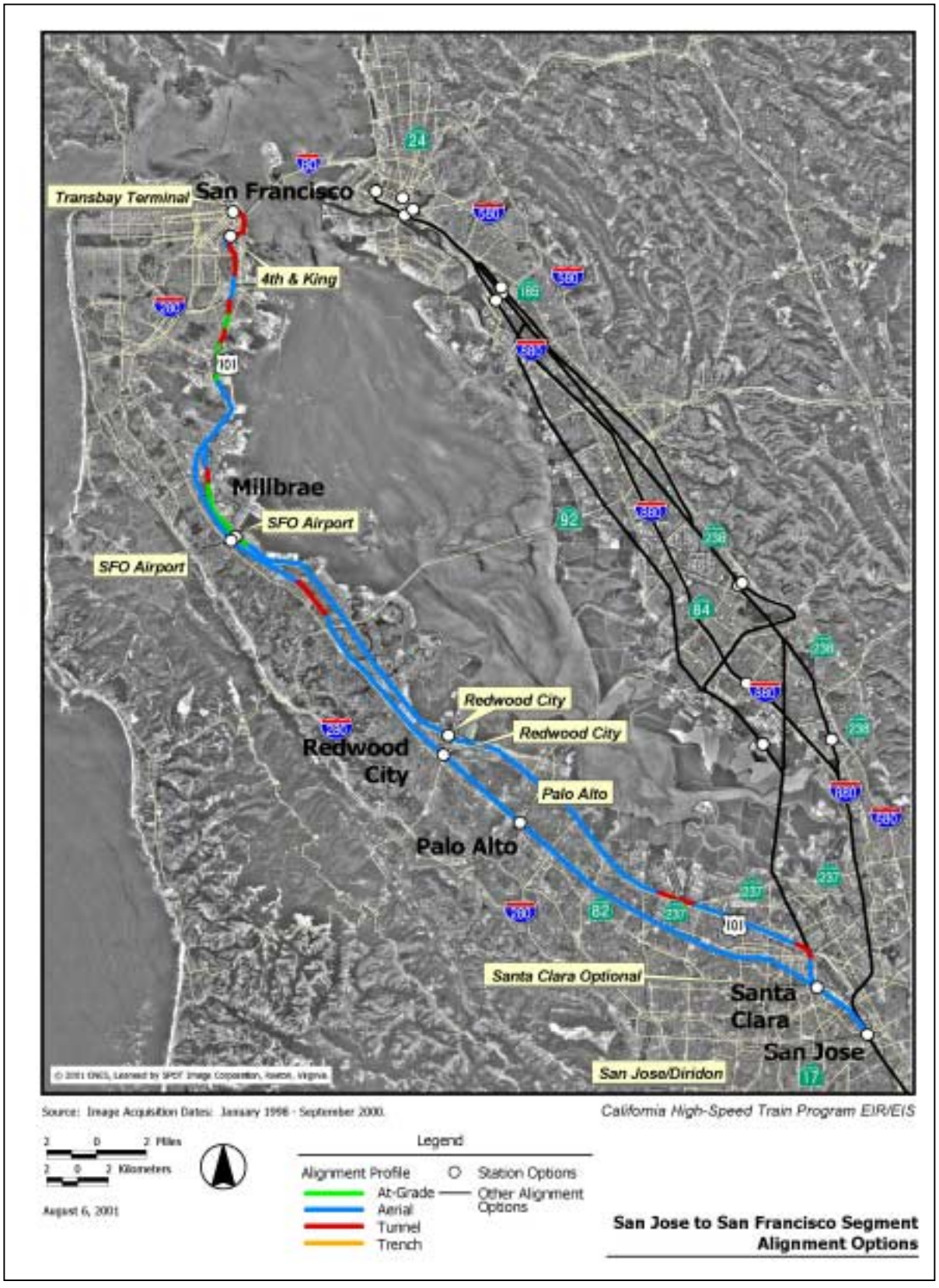
- Shared use of track with the Peninsula Commute Joint Powers Board Caltrain commuter rail service – Basic Service Option. This option applies the VHS operation and assumes full grade separation of all rail crossings but limited station improvements, and

- Shared use of Caltrain track with both grade separation and station improvements allowing for four-track stations or station bypass tracks.

Subsegments for each of these options are described below.

Exclusive Guideway The exclusive guideway alignment would consist mostly of an aerial structure generally along side of the existing and proposed Caltrain tracks. Caltrain currently has two tracks from San Jose to San Francisco, but has plans to expand to three or four tracks throughout Santa Clara and San Mateo County, except for two sections through Redwood City and San Mateo. The portion in San Francisco would remain at two tracks.

Figure 3.3-3: Alignments and Stations for the San Jose-to-San Francisco Segment



The existing ROW in most locations is sufficient for Caltrain's proposed expansion but not for any additional high-speed train guideway adjacent to Caltrain's tracks. There may be some opportunities to construct piers for the separate guideway aerial structure within the available ROW after the expansion, but even in these locations, property would need to be acquired for pier foundations and the guideway itself overhanging the ROW line. The choice on which side of the corridor to locate the guideway will generally depend on the relative costs and impacts of existing ROW on either side.

A special aerial structure supported on bents that span the Caltrain tracks below would be needed wherever the guideway crosses from one side to the other. Due to the high speeds desired for the trains, the skew angle of the structure would be quite large, and the structure very long.

There are numerous road and highway overcrossings over the Caltrain tracks. The aerial guideway would need to pass over these roads, and for the VHS option, would place the tops of centenary poles over 70 feet above the ground.

The guideway would be on an aerial structure at the San Jose Station. It would continue along the west side of the corridor until just north of the Santa Clara Yard. From Santa Clara to Mountain View, the guideway would follow along the west side of the Caltrain corridor. Between Route 237 and Castro Street in Mountain View, the Tasman LRT runs along the east side of Caltrain. A special aerial structure that spans both Caltrain and Tasman tracks would be required.

From Castro Street north to Palo Alto, the Central Expressway (Alma Street in Palo Alto) runs adjacent to Caltrain on the east side. There may be opportunities to fit aerial guideway structure piers between the tracks and the road, with foundations constructed below and the guideway superstructure extending over both the tracks and the road. However, there are many trees along the street, including Palo Alto's namesake along Alma Street that could affect this configuration.

The Caltrain ROW widens at the Palo Alto Station. The station historically had four tracks, which is the number planned in Caltrain's expansion. If a high-speed train station were located here, the four-track station would be built on an aerial structure above the Caltrain tracks and station.

The guideway would continue on the east side of the Caltrain tracks until Redwood City. Alma Street runs along the east side of the tracks through Menlo Park. Private property with high-cost residences would have to be acquired through Atherton.

The Caltrain ROW in downtown Redwood City is only 40 feet wide, and there is commercial development abutting the ROW on both sides. Buildings are located on the west side, and a parking lot for a shopping center is located on the east side. The Caltrain expansion plan has no provisions to add tracks at this location, which is where the Redwood City Station would be located. The guideway would have to be constructed on a special box structure located above the tracks, with piers on the outsides of the tracks. If a 4-track station were located at Redwood City, the aerial structure could possibly extend over the parking lot on the east side of Caltrain.

North of Redwood City, the guideway would cross to the west side of Caltrain until the central part of San Mateo. At this location, which extends for about one mile, the Caltrain ROW is narrow, and Caltrain has no plans for expansion. There are numerous at-grade crossings in the City of San Mateo, as well as four underpasses constructed in the early 20th century that have insufficient vertical clearance for vehicles. The City's prior expressed preference is for a belowground Caltrain configuration to alleviate these issues, so an aerial structure for a high-speed train guideway appears to be inconsistent with this preference. Consequently, the

proposed configuration is a deep bore tunnel under the Caltrain tracks. The tunnel would start just north of Route 92 and would end near the Burlingame City line, where an aerial structure would start. Transitions between aerial structure and tunnel at each end will require additional ROW for the guideway.

The elevated guideway would be located on the west side of the Caltrain tracks through Burlingame. California Drive is located immediately west of the tracks through most of the City, so there may be opportunity for the guideway to share the street and track rights of way, similar to the situation along the Central Expressway and Alma Street. However, there are many tall trees between the street and the tracks that could preclude this solution.

The BART Millbrae Station is under construction just north of the Millbrae Avenue overcrossing. BART tail tracks run on the east side of Caltrain south of Millbrae Avenue. The Caltrain Millbrae depot building and parking lot are located on the west side of the tracks. The BART mezzanine extends over the Caltrain tracks, with pedestrian access coming down on the west side of the Caltrain tracks. In addition, the Caltrain expansion plan shows two additional tracks on the west side, and one additional track on the east side. However, there appears to be room for an elevated, four-track high-speed train station located above the parking lot. The historic depot building would have to be removed or relocated as part of the planned Caltrain expansion. The guideway would cantilever over California Drive, located west of the parking lot. The guideway structure would be high, as it would need to pass over Millbrae Avenue, which itself passes over the Caltrain tracks.

From Millbrae to San Bruno, the BART SFO extension is located on the east side of Caltrain. The elevated guideway would need to be on the west side of Caltrain. North of San Bruno Avenue, the guideway could remain on the west side or cross over Caltrain to the east side. More detailed study would be needed to make this decision, as the Caltrain alignment has several curves in it that would restrict speeds for high-speed trains.

From Sierra Point north to the Caltrain Bayshore Station, just north of the San Francisco County line, the Caltrain corridor passes through an area that was the former SP yard. The land is currently vacant but is planned for development by the City of Brisbane. It is possible that the guideway could be at-grade through this area.

As the guideway approaches the Caltrain Bayshore Station, it would need to rise up on an aerial structure. The San Francisco Municipal Railway is currently designing a light rail station just west of the Caltrain Bayshore Station. The guideway could pass over the station area.

The configuration of the guideway within the City and County of San Francisco is complicated. The existing Caltrain tracks pass through four tunnels before emerging under the I-280 freeway structure at 16th Street. The tunnels are numbered consecutively from the north. Each of the tunnels is a single bore with two tracks. Between tunnels 3 and 4, the tracks are generally at or below grade. Paul Avenue crosses over the tracks. Between tunnels 2 and 3, the tracks are generally on an embankment with several streets crossing under the tracks. Between tunnels 1 and 2, where the 22nd Street Caltrain Station is located, the tracks are actually underneath the I-280 freeway structure. Tunnel 2 has a second bore to the west of the tracks. This tunnel does not have any tracks in it.

After emerging from Tunnel 1 at 16th Street, the Caltrain tracks turn north and follow the east side of 7th Street. The tracks are under the I-280 freeway. After passing the Mission Creek, the tracks turn east again between King and Townsend Streets to the San Francisco terminal at 4th Street. The proposed extension of Caltrain to the downtown SF terminal would descend into a

cut-and-cover subway under Townsend Street just west of 4th Street. The tracks would continue in a cut-and-cover subway under Townsend Street, turn north under 2nd Street, and east again to the terminal located in the blocks surrounded by Mission Street, Howard Street, First Street and Beale Street. Both Townsend Street and 2nd Street have 82.5-ft ROW widths. The proposed subway would effectively use up available space under the streets.

Two options have been developed for the San Francisco portion of the alignment. The two are the same from the City line to 17th Street. Each has a different location for the San Francisco terminal station.

For each option, a separate high-speed train guideway would be located to the west of the existing Caltrain tracks from south of Tunnel 4 to the north end of Tunnel 3. The guideway could be at grade between Tunnels 3 and 4, and on aerial structure between Tunnels 2 and 3. The guideway could potentially stay on the west side of the tracks, possibly even using the existing second bore of Tunnel 2, with a new Tunnel located west of Tunnel 1.

North of 16th Street, there is no room for a separate guideway adjacent to the proposed subways under Townsend Street and 2nd Street currently under review for the Caltrain Downtown Extension. For an exclusive guideway extending to the proposed Caltrain Downtown San Francisco Station, the most feasible location appears to be one of the original alignments proposed for the Caltrain downtown San Francisco Station extension. This would be a tunnel under King Street and the Embarcadero as far as Main Street, where the alignment would turn north in a cut-and-cover subway under Main Street to Howard Street. From there, the subway would turn west and enter the proposed downtown station from the opposite end (east end) as the Caltrain tracks.

For this configuration to work, the guideway would need to descend in a separate tunnel that would pass under Caltrain either in the vicinity of Tunnel 1 or along 7th Street. The precise location and configuration of the high-speed train tunnel between 16th Street and King Street would need to be studied extensively. There are many obstacles, including the I-280 freeway structure foundations, Mission Bay development, MUNI LRT tracks, the Division Street outfall sewer and sewage pump station, Mission Creek, and the Caltrain tracks. The tunnel would have to be sufficiently deep to avoid affecting any of these facilities. Ground conditions are variable, so it is likely that several tunneling methodologies would be needed. For this option, due to the need to be in a deep tunnel, there is no opportunity to locate a high-speed train station in the Mission Bay area.

An optional alignment similar to the first option would emerge from the tunnel in the vicinity of 17th Street, but would turn north and follow 7th Street on an aerial structure to a terminal located above the current Caltrain terminal and yard between Townsend and King Streets. This location would allow a multi-track high-speed train station, but would not allow any extension to the proposed Caltrain downtown San Francisco Station at the Transbay Terminal.

Thus, for the separate use high-speed train options, the terminal station in San Francisco would either be at 4th and King or at the Transbay Terminal. An alignment that permits stations at both the Transbay Terminal and Mission Bay areas does not appear to be feasible.

Shared Use The Shared Use option would apply only for the VHS steel-wheel-on rail technology. For this option, the high-speed trains would run on the Caltrain tracks from San Jose to San Francisco. It is assumed that issues of FRA compatibility and California Public Utiltities Commission (CPUC) clearances to high platforms, if applicable, would be resolved. It is also

assumed that the proposed Caltrain electrification and train control will be compatible with high-speed trains.

Caltrain stations have low (eight inches above top of rail maximum) platforms. This is due to CPUC regulations regarding horizontal clearances for conventional railroads. Current Caltrain passenger cars have steps that allow passengers to ascend from the platforms to the car floors. Special lifts are provided at stations for wheelchair accessibility. If high-speed trains were to share Caltrain platforms, under current CPUC regulations the rolling stock would need to be equipped with stairs or steps. This is technically feasible, but dwell times would increase. Other solutions to allow boarding at floor level are possible, but CPUC clearance regulations will need to be addressed.

Freight operations on the peninsula line are currently restricted to off-peak hours. If CPUC and FRA compatibility issues are resolved, then high-speed trains could presumably operate on the same tracks as mixed freight and Caltrain traffic. From a practical standpoint, however, high-speed train schedules could be negatively affected if slower speed freight trains are using the same tracks. Night-time freight operation would be preferable.

Two scenarios have been identified for the Shared Use option. In the first scenario, referred to as the Basic Service Option, high-speed trains would use Caltrain express tracks where they exist and use the local tracks in such places as Redwood City, San Mateo, and San Francisco, where there are no additional tracks currently planned by Caltrain. The high-speed trains would operate at the same maximum authorized speeds as Caltrain. High-speed trains that make stops along the peninsula would stop at either Redwood City (where there are only two tracks planned for Caltrain) or Palo Alto (where there are four tracks planned), and at Millbrae (San Francisco International Airport), where four tracks are planned. Additional crossovers may be needed between the express tracks and local station tracks for high-speed train operations. No other track modifications would be needed for the high-speed train operations.

One of the criteria for the high-speed train system is that the tracks be completely grade separated. There are currently 47 at-grade crossings of streets between San Jose and San Francisco on the Caltrain route, all but 10 of them in San Mateo County. High-speed train operations would require that all of these at-grade crossings be removed. The Caltrain improvement plan provides for closing a few of them. All the others would need to be replaced by grade separations.

Four configurations of grade separations are possible. The terminology used in this study is as follows:

- UP = Underpass (RR stays at grade; road passes under)
- OC = Overcrossing (RR stays at grade; road passes over)
- OH = Overhead (Road stays at grade, RR passes over on an approach embankment)
- UC = Undercrossing (Road stays at grade; RR passes under in a trench)
- X = Closure (Road Closed at tracks)

The preliminary type of grade separations proposed at each of the existing locations is shown in Table 3.3-1:

Table 3.3-1
Preliminary Types of Grade Separations
Assumed for Caltrain Corridor High-Speed Train Alignment --
Merced-to-San Jose Segment

City	Location	MP	No. of Tracks Planned	Type	Comments
San Francisco	King Street			X	
San Francisco	16th Street	1.1	3	UP	Freeway structure above precludes an OC
South San Francisco	So. Linden	10.2	4	UP	
South San Francisco	Scott	10.6		X	Closed in Caltrain improvement plan
San Bruno	San Bruno Ave	11.0	4	OC	BART passes below Caltrain; I-380 to north precludes an OH
San Bruno	San Mateo Ave	11.0	4	OC	Realign to intersect San Bruno Ave.
San Bruno	Angus	11.4	4	OC	
Millbrae	Center	12.8	4	OC	BART adjacent and below grade precludes and UP
Burlingame	Broadway	15.2	3	OC	
Burlingame	Oak Grove	15.9	3	OC	
Burlingame	North Lane	16.2	3	OC	Siding to remain at grade
Burlingame	South Lane	16.3		X	Closed in Caltrain improvement plan
Burlingame	Howard	16.4	3	OC	Siding to remain at grade
Burlingame	Baywater	16.5	3	OC	Siding to remain at grade
Burlingame	Peninsula	16.6	3	OC	
San Mateo	Villa Terrace	16.9	2	UC	
San Mateo	Bellevue	17.1	2	UC	
San Mateo	Poplar	17.2	2	UC	Current UP with insufficient vertical clearance
San Mateo	Santa Inez	17.3	2	UC	Current UP with insufficient vertical clearance
San Mateo	Diablo	17.5	2	UC	Current UP with insufficient vertical clearance
San Mateo	Tilton	17.5	2	UC	Current UP with insufficient vertical clearance
San Mateo	1st	17.7	2	UC	
San Mateo	2nd	17.8	2	UC	
San Mateo	3rd	17.9	2	UC	
San Mateo	4th	18.0	2	UC	
San Mateo	5th	18.1	2	UC	

City	Location	MP	No. of Tracks Planned	Type	Comments
San Mateo	9th	18.3	2	UC	
San Mateo	25th	19.7	4	OC	
Redwood City	Whipple	24.8	2	OH	
Redwood City	Brewster	25.2	2	UP	
Redwood City	Broadway	25.4	2	UP	
Redwood City	Maple	25.7		X	Closed in Caltrain improvement plan
Redwood City	Main	25.8	2	UP	
Redwood City	Chestnut	26.0	3	UP	Siding track to west
Atherton	Fair Oaks	27.7	3	OH	
Atherton	Watkins	28.0	3	OH	
Atherton	Encinal	28.4	3	OH	
Atherton	Glenwood	28.6	3	OH	
Menlo Park	Oak Grove	28.8	3	OH	
Menlo Park	Ravenswood	29.0	3	OH	
Palo Alto	Alma	29.8	4	UP	
Palo Alto	Churchill	31.0	4	OH	
Palo Alto	Meadow	33.0	4	OH	
Palo Alto	Charleston	33.4	4	OH	
Mountain View	Rengstorff	34.7	4	UP	
Mountain View	Castro	35.9	2	UP	
Sunnyvale	Mary	37.9	3	UP	
Sunnyvale	Sunnyvale	38.9	4	UP	

Each grade separation would create impacts that extend beyond the immediate vicinity of the grade separation structure itself. An underpass or overcrossing would result in loss of access to properties abutting the road. An underpass or undercrossing would require underground utility relocation. Gravity sewers are particularly affected. For an undercrossing, the track needs to start descending about a half mile before the grade separation structure.

The types of grade separations proposed in the above list are preliminary, based on a cursory study of the entire corridor. Detailed plans and profiles would need to be developed for each crossing to ensure the feasibility of the entire grade separation concept.

Under the second Shared Use option, referred to as the Four-track Station Option, additional improvements would be made to Caltrain tracks beyond the planned Caltrain expansion plans to allow express tracks through all local stations. This would conform to the high-speed train criteria. The additional improvements would consist of exclusive high-speed train double tracks in San Mateo, Redwood City, and San Francisco where Caltrain is expected to have only two tracks, and one additional exclusive high-speed train track in areas where Caltrain is expected to have only three tracks. Turnouts would be provided at the ends of the bypass segments to connect to the Caltrain express tracks.

For this alignment, a double track exclusive guideway in San Francisco would extend from the Bayshore Station to the north portal of Tunnel 1, and would have the same configuration as with the exclusive guideway alignment (a combination of tunnels, at grade and aerial structure). In

San Mateo, the guideway would be in a tunnel under the Caltrain tracks. An aerial structure would be constructed through Redwood City. Stations that would need to be bypassed by the double track guideway are: (1) 22nd Street, San Francisco, (2) Paul Avenue, San Francisco, (3) San Mateo, and (4) Redwood City.

The single-track guideways would be on aerial structure to bypass the following stations: Broadway, Burlingame, Atherton, Menlo Park, Mountain View, Sunnyvale, Santa Clara, and College Park.

With a double track exclusive guideway constructed for the high-speed trains, some of the grade separations estimated for the Basic Service Option would not be needed. These separations are located in San Mateo and Redwood City (if a local high-speed train station were not there). Specific grade separations that would not be needed are:

- In the City of San Mateo: Villa Terrace, Bellevue, Poplar, Santa Inez, Mount Diablo, Tilton, 1st, 2nd, 3rd, 4th, 5th, and 9th, and
- In Redwood City: Whipple, Brewster, Broadway, Main, and Chestnut

B. U.S. 101 ALIGNMENT

The U.S. 101 corridor between San Jose and San Francisco is one of the most developed of the Bay Area. The existing freeway consists of four lanes in each direction. The left lane is a high-occupancy vehicle (HOV) lane in peak hours in both directions. The median shoulder varies from 4 to 10 feet. The right shoulder varies between 8 to 10 feet. The 10-foot median shoulder is needed for enforcement of the HOV lanes. The current standard is 14 feet. The ROW varies with sections built out to the ROW lines. The freeway frequently exceeds capacity. It is of an older design with sections not meeting current design standards.

The U.S. 101 high-speed train alignment would begin in San Jose in the Caltrain corridor on aerial structure and would depart at the interchange with Route 82/Coleman Avenue and De La Cruz Boulevard. The alignment would be over 50 feet in the air above the tracks to pass over the existing overhead structure at Route 82. The alignment would head north along the west side of the existing UPRR track on aerial structure 23 feet above the UP track requiring ROW acquisitions of commercial and industrial land uses. It would transition to an at-grade alignment after passing over the Martin Avenue crossing of the Central Expressway at approximately the same elevation as the UP rail line. The transition would take place in a parking area for commercial property.

The alignment is presumed to be in a cut-and-cover section of tunnel to avoid the fight path of the San Jose International Airport and be grade separated from the overcrossing of Lafayette Street. The alignment would curve into the U.S. 101 corridor along the west side of U.S. 101, requiring acquisition of industrial properties between Lafayette and the Central Expressway. It would transition from below grade to aerial structure 40 to 50 feet above U.S. 101 to pass over the overcrossing at Tomas Expressway. The transition would take place on the frontage road, Duane Avenue between Raymond Street and Lafayette.

The alignment would continue elevated 40 to 50 feet above U.S. 101 on the west side of the freeway in to pass over the overcrossing of Bowers Avenue, the Lawrence Expressway, and Fair Oaks Avenue.

The alignment would then cross into the median of U.S. 101 between Fair Oaks and Mathilda by using bents across the southbound lanes. U.S. 101 would need to be widened to each side to accommodate the columns. The median would also need to be widened to accommodate columns between Borregas to north of Route 237. Both directions of U.S. 101 would need to be rebuilt in this area. The frontage road ROW on Ahwanhee between Mathilda and Borregas would be used to shift the southbound lanes to the west.

The Mathilda/U.S. 101 interchange would be changed from an overcrossing to an undercrossing of U.S. 101 to allow the alignment to transition from an aerial structure into a cut-and-cover structure or a tunnel. This would be to done avoid the flight path of Moffet Field and to be grade-separated from the SR-237/U.S. 101 interchange. The Route 237 interchange would need to be rebuilt.

The cut-and-cover alignment would cross under the northbound U.S. 101 lanes and follow under a frontage road from Manila Drive to Ellis. The alignment would then run north of the northbound Ellis on ramp to U.S. 101. The freeway would need to be shifted to the south using the frontage road and Fairchild Drive ROW between Leong Drive and National Avenue. This would allow the alignment to transition to aerial structure before Steven's Creek.

The alignment would continue elevated 40 to 50 feet above U.S. 101 on the east side of the freeway to pass over the overcrossings from Moffet Blvd to North of Peninsula Blvd.

A 4-track station is proposed north of Woodside Road in Palo Alton. This station would be elevated to provide clearance for a UP spur track north of the interchange.

The alignment would need to climb to the fourth level approximately 75 feet above U.S. 101, flying over both Route 92 and the southbound and eastbound flyover ramps. It would then descend to 40 to 50 feet above U.S. 101 on the east side of the freeway.

The alignment would cross over U.S. 101 from the east side to the west side, south of the Broadway/U.S. 101 interchange. This would require bents over both the northbound and southbound lanes. Northbound and southbound mainline lanes would be reconstructed and the median would need to be widened. After crossing the freeway, the alignment would run between the frontage road and the southbound lanes on U.S. 101. North of David Road, the alignment would curve over and run adjacent to the PGE Power line easement and descend to grade. The San Francisco Airport flight path may limit the height of the alignment in this area.
The Millbrae Interchange would be rebuilt to allow for the Millbrae overpass of U.S. 101 to be extended over the high-speed train alignment. A 4-track at-grade station would be located in current industrial/commercial property east of Rollins Road just south of Adrian Road. . The alignment would continue at-grade utilizing vacant land between the PGE Easement and southbound lanes of U.S. 101.

The PGE power towers near Marino Vista Park would need to be relocated to allow for the alignment. The alignment would need to be at-grade to pass under BART into the San Francisco International Airport.

The alignment would pass under San Bruno Avenue using land between the PG&E easement and southbound lanes of U.S. 101. The alignment would pass under the I-380 interchange in a tunnel. The alignment would then transition to an elevated structure north of I-380. The alignment would cross over U.S. 101 into the Caltrain corridor north of Grand Avenue, requiring modifications to U.S. 101. Bents would be used over both the southbound and northbound lanes

of U.S. 101. From this point north, the alignment would be the same as the Caltrain corridor exclusive guideway alignment described above.

3.3.3 San Jose-to-Oakland Segment

The following alignments and stations were evaluated for the San Jose-to-Oakland Segment:

- **Mulford Line (Entire Segment)**: From San Jose, this alignment would follow north along UPRR's entire Mulford rail line. Station options include Auto Mall Parkway, Oakland Airport/Coliseum, and downtown Oakland at one of the following locations: Lake Merritt, Jack London Square, West Oakland, or 12th Street/City Center.

- **I-880 (Entire Segment)**: From San Jose, this alignment would follow I-880 north to Oakland. Station options include Mowry Avenue, Oakland Airport/Coliseum I-880/Hagenberger, and downtown Oakland at one of the following locations: Lake Merritt, Jack London Square, West Oakland, or 12th Street/City Center.

- **I-880 to the Hayward Line (I-880/Hayward Alignment)**: From San Jose, this alignment would follow north along I-880 and then transition to UPRR's Hayward rail line. Station options include either the planned Warm Springs (Bay Area Rapid Transit -- BART Station) or the Union City (BART Station), Oakland Airport/Coliseum, and downtown Oakland at one of the following locations: Lake Merritt, Jack London Square, West Oakland, or 12th Street/City Center.

- **I-880 to the Hayward Line to the former WPRR Rail Line (I-880/Hayward/WPRR Alignment)**: From San Jose, this alignment would follow north along I-880, transition to UPRR's Hayward rail line, and then transition to the UPRR (old WPRR) rail line. Station options include either the planned Warm Springs (BART Station) or the Union City (BART Station), Oakland Airport/ Coliseum, and downtown Oakland at one of the following locations: Lake Merritt, Jack London Square, West Oakland, or 12th Street/City Center.

- **Mulford Line through Niles Junction to the Hayward Branch (Mulford/Niles/Hayward Alignment)**: From San Jose, this alignment would travel north along UPRR's Mulford rail line to the UPRR's Niles line and then onto UPRR's Hayward line. Station options include either the planned Warm Springs (BART Station) or the Union City (BART Station), Oakland Airport/Coliseum, and downtown Oakland at one of the following locations: Lake Merritt, Jack London Square, West Oakland, or 12th Street/City Center.

- **Mulford Line via a tunnel to the Hayward Line (Mulford/Tunnel/Hayward Alignment)**: From San Jose, this alignment would follow north along UPRR's Mulford rail line to a tunnel leading to UPRR's Hayward rail line. Station options include either the planned Warm Springs (BART Station) or Union City (BART Station), Oakland Airport/Coliseum, and downtown Oakland at one of the following locations: Lake Merritt, Jack London Square, West Oakland, or 12th Street/City Center.

- **Mulford Line through Niles Junction to the former WPRR Rail Line (Mulford/Niles/WPRR Alignment)**: From San Jose, this alignment would follow UPRR's Mulford rail line to UPRR's Niles line, onto the UPRR's Hayward line, and then to the UPRR (formerly WPRR) rail line. It would have stations at either the planned Warm Springs (BART Station) or the Union City (BART Station), Oakland Airport/Coliseum, and in downtown Oakland at one of the following locations: Lake Merritt, Jack London Square, West Oakland, or 12th Street/City Center.

- **Mulford via a tunnel to the Former WPRR Line (Mulford/Tunnel/WPRR Alignment)**: From San Jose, this alignment would follow UPRR's Mulford rail line to a tunnel leading to UPRR's Hayward

line and then transition to the UPRR (former WPRR) rail line. Station options include the planned Warm Springs (BART Station) or the Union City (BART Station), Oakland Airport/Coliseum, and downtown Oakland at one of the following locations: Lake Merritt, Jack London Square, West Oakland, or 12th Street/City Center.

Figure 3.3-4 shows the alignments and stations for the San Jose-to-Oakland Segment. Subsegments for each of the alignments are described below.

A. MULFORD ALIGNMENT – ENTIRE SEGMENT

For the Mulford line Alignment, the high-speed train alignment would follow the UPRR corridor along its Coast line. The alignment would be within the corridor identified in the *California High-Speed Train Business Plan* (June 2000). The business plan suggested an at-grade solution for the entire route, but this solution no longer appears to be feasiblt due to the width of the corridor and the numerous spur tracks along this line. The corridor is generally 60 feet wide with short sections of 50 feet in the commercial areas of Santa Clara and 100 feet through the San Francisco Wildlife preserve. The route would pass through commercial areas, a major wildlife preserve, residential areas including a mobile home park, and industrial areas.

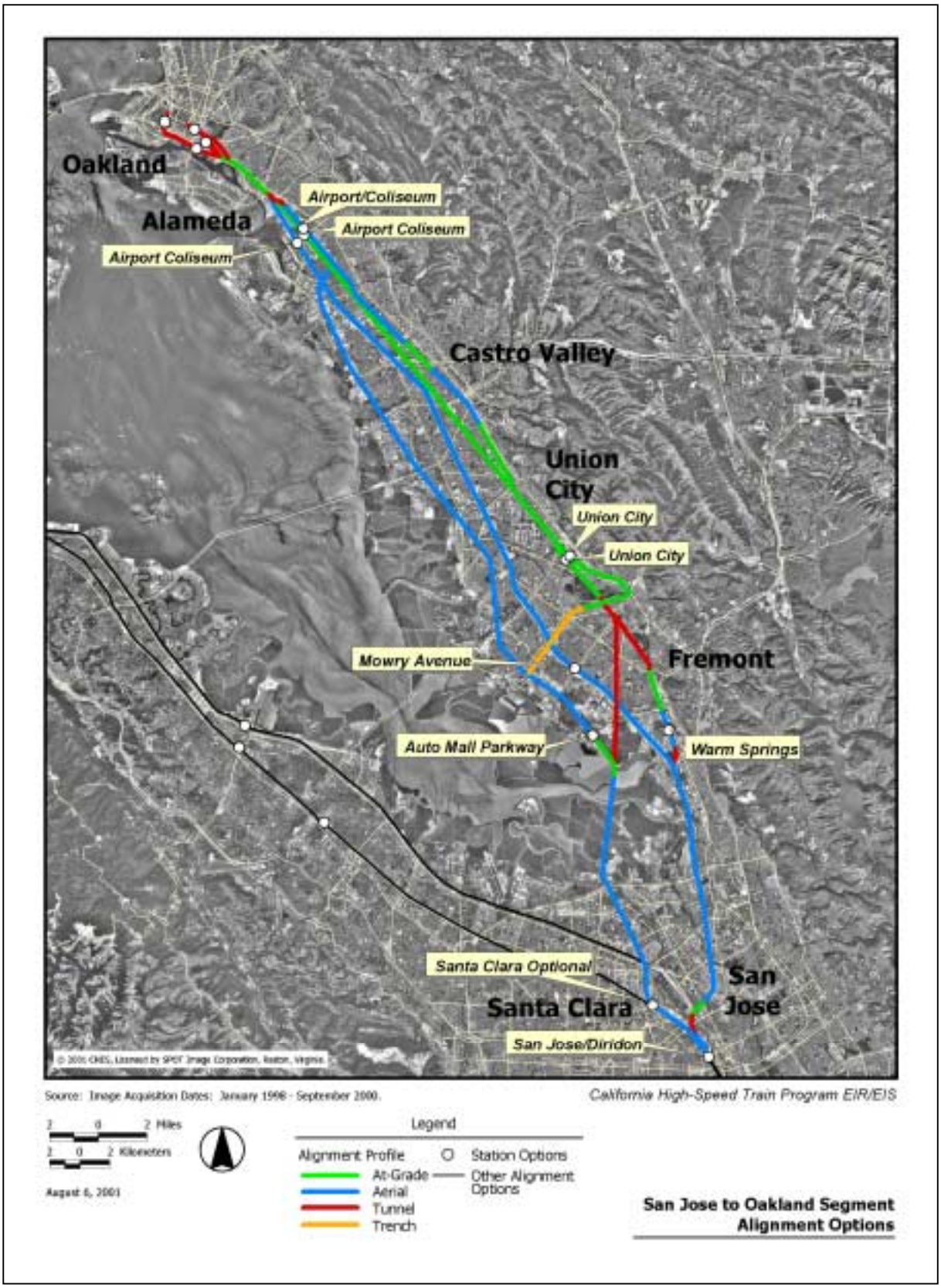
The route would be generally on aerial structure throughout the entire length from Santa Clara to the Oakland Coliseum area. The alignment would need to cross several drainages, rivers and wetlands. A potential midline station location could be located in the Fremont area near Auto Mall Parkway. A high-speed train station would be planned near the Oakland Coliseum and Airport. In the Oakland area, the *California High-Speed Train Business Plan* suggested a tunnel alignment within the existing rail corridor to a terminal at Jack London Square. This terminal location would require being very deep to pass below existing roadway tunnels to Alameda Island for the required tail track and any future extension to Sacramento and/or San Francisco.

The Mulford alignment would start on an aerial structure within the Caltrain corridor in Santa Clara near the De La Cruz/El Camino Real Interchange, just to the north of the Santa Clara Caltrain Station. The UPRR would need to agree to sell a portion of its ROW throughout the length of the Mulford line Alignment. Present design speeds for passenger trains along the corridor vary from a top speed of 79 mph to a low of 30 mph.

Caltrain is proposing to re-construct three at-grade tracks in this throat area as the Mulford line meets the Caltrain route: two for the UPRR and one for Caltrain. The ROW is 70 feet wide in the area from De La Cruz to Reed Street and 60 feet wide to the U.S. 101 interchange. Adjoining properties are generally older light industrial facilities. To allow for the construction of high-speed tracks on aerial structure, an additional 25 feet would need to be purchased in the throat area to Reed Street and 25 feet to the U.S. 101 interchange. From U.S. 101 to SR-287, the ROW is generally 50 feet wide and is located between Lafayette and Basset Street in a commercial area. A minimum of 10 feet would have to be purchased with an additional easement over the roadway of 20 feet.

For the alignment from SR-287 through Alviso, the ROW is 50 to 60 feet wide. Aerial structure is again proposed to minimize the acquisition of residential and commercial properties in Alviso. Ten feet of additional property would need to be purchased with a 20-foot aerial easement in addition.

Figure 3.3-4: Alignments and Stations for the San Jose-to-Oakland Segment



Through the San Francisco National Wildlife Refuge, the ROW is 100 feet wide, which would be adequate to provide for two high-speed train tracks plus two additional tracks that could be shared by freight and commuter rail traffic. The separation between the high-speed train tracks and the UPRR tracks would be 40 feet. The present track is on embankment, and the alignment is proposed to be on a low aerial structure to allow free flow of water beneath the tracks. The ROW width remains at 100 feet to Mayhews Landing Road in Newark. After the Wildlife Refuge, the alignment is proposed to be at-grade for approximately four miles to just south of Mowry Avenue, where it would transition to aerial structure to pass over numerous sidings and roadways. Present rail traffic on this corridor consists of UPRR freight traffic, AMTRAK Coast Starlight, AMTRAK Capitol Corridor, and ACE commuter trains. All service providers are looking for ways to increase capacity and service through this area.

From Mowry Avenue, the alignment would remain on aerial structure to 98th Avenue in Oakland, where it would cross over the Hayward railroad Branch. Between Mowry Avenue and Mayhews Landing, no additional ROW would be required. This area is generally light industrial. North of Mayhews Landing, the ROW is generally 60 feet wide, and an additional 20 feet of ROW would be required – either as a full take or aerial easement. The adjoining properties are generally residential through Newark, Fremont, Union City and portions of Hayward, San Lorenzo and San Leandro. There are numerous railroad sidings in San Leandro to serve the industrial clients along the corridor. The route would pass between the Hayward Regional Shoreline on the west of the corridor and the Public golf course and San Lorenzo Park to the east.

After crossing over the Hayward Branch, the route would continue at-grade on the east side of the ROW to the Coliseum/Airport Station. A minimum of a 50-foot width of additional right-of-way would be required for the entire length to allow for the construction of the aerial structures. There would be two high-speed train tracks and two tracks for the UPRR and AMTRAK with a potential siding or third freight track on the far west side of the corridor. A 21-foot separation is assumed between the high-speed train tracks and the freight tracks, 20 feet between the freight tracks, and 15 feet between sidings and freight tracks. The Airport Coliseum Station is assumed at-grade alongside the BART/AMTRAK station for the Capitol Corridor. The station would be a four-track, two-platform station. The present configuration assumes no express tracks, and all high-speed trains would stop at this location. UPRR and BART are discussing purchasing 50 feet of ROW in this area. Further operational analysis should verify whether express tracks are needed. Shared use with the Capitol Corridor trains would eliminate this need, although further study is needed for this Shared Use option. An additional 60 feet of ROW is needed at this location. The express tracks would require additional ROW. The concourse is assumed above the platforms, with possible joint development over the site. The concourse could connect to BART, the planned Oakland Airport Connector, and the adjoining Amtrak station.

The alignment would continue at-grade within the 100-foot wide corridor to approximately 17th Avenue in Oakland. There are five at-grade crossings in this area, which would need to closed or grade separated. Fiftieth Avenue is assumed to be closed, with the remaining four crossings being grade separated.

The last part of this subsegment would be an Oakland terminal station. For descriptive purposes, the Mulford line Alignment is assumed to end at a terminal station in West Oakland. There are three other terminal options for Oakland: Jack London Square, Lake Merritt, and City Center. Each of the four terminal station locations and alignments are described below.

West Oakland Terminal Station Option For this terminal station, the Mulford Alignment would continue at-grade adjacent to the railroad tracks, leading to a tunnel portal in the vicinity of 8th Avenue. The tunnel is assumed as twin bores. High-speed trains would be traveling at fairly low speeds, and the large volume tunnels would not be necessary. The tunnel would have to be fairly

deep – approximately 100 feet – to pass below the Alameda street/highway tubes. The ROW also narrows from 100 to 80 feet for a four-block section, requiring the narrower tunnels or a stacked tunnel. The bored tunnels would continue to the west of Adeline Street and transition to a cut-and-cover subway section, turning sharply north into the median of Mandela Parkway to a West Oakland terminal station located directly north of 7th Street.

The terminal station option is proposed to be located next to the BART West Oakland Station in a subway configuration. It is proposed to be within the Mandela Parkway Street ROW in a residential/commercial/light industrial area. It would be within a one-or two-block walking distance to the existing West Oakland BART Station. A direct underground concourse to the BART station is proposed, providing intermodal connections to all five of the BART destinations: San Francisco, Richmond, Pittsburgh, Dublin, and Fremont. Existing AMTRAK service would not be available at this location. A future extension could be via a depressed or cut-and-cover subway section along Mandela Parkway to the existing UPRR corridor in Emeryville. Local roadways would go over the high-speed tracks via short bridge sections.

The platform level is assumed as two tracks with two side platforms. Future operational analysis would need to verify whether additional tracks are required. The concourse level would be slightly below grade within the Parkway to allow for a direct subway connection to the BART West Oakland Station plaza. The tracks would continue in a depressed or cut-and-cover subway section for an additional 2,700 feet allowing for storage and turnback facilities.

Jack London Square Terminal Station Option The route to the Jack London Square Terminal Station would begin as the West Oakland route described above. The tunnel portal would be in the same location. The profile in the area north of the portal would need to be steeper to place a deep platform beneath the existing AMTRAK station near Alice Street in Jack London Square. The terminal station would be a deep mined platform with a concourse directly above. The platform is assumed to be a center configuration. The concourse would transition to the east directly below the existing AMTRAK parking lot to a deep excavation from the surface, a secondary concourse below the parking area, and a direct connection to the existing AMTRAK station.

The tracks would continue in a mined and bored tunnel section an additional 2,700 feet for storage and turnback facilities to near Oak Street. This terminal station would provide direct connection to the AMTRAK Capitol Corridor trains but not to the BART lines. In the future, the line could be extended to rejoin the UPRR corridor at 40th Street near Emeryville. This extension could follow the UPRR corridor.

Constructing the deep mined platform and concourse level below the active railroad tracks would be a major construction issue. This is directly adjacent to the Inner Harbor with the accompanying soil and groundwater issues. The AMTRAK parking lot would be disrupted and unavailable during the construction period. Underground easements would be required from the UPRR and AMTRAK.

Lake Merritt Terminal Station Option The Lake Merritt Terminal Station Option would be located in a subway configuration near BART's Lake Merritt Station. It would be located in a commercial/residential area within a one block walking distance to the existing BART Station. A direct underground concourse to the BART Station is proposed to provide intermodal connections to four of the BART destinations: San Francisco, Richmond, Dublin, and Fremont. Connections to existing AMTRAK service would not be available at this location. Future extension could be via a bored tunnel section along 7th Street to the existing UPRR corridor in West Oakland.

This terminal station option would again begin at 17th Avenue in an at-grade configuration and transition to a bored tunnel configuration near 9th Avenue. It would then pass below 8th, 7th Street, Laney College, and the outlet channel from Lake Merritt to a terminal station location near Oak Street. The station is assumed to be below grade with a two-track center platform configuration. The concourse would be directly above the tracks, with a direct below ground connection to the Lake Merritt BART Station. The tracks would continue in a cut-and-cover section an additional 2,700 feet for storage and turnback facilities to near Webster Street. In the future, the line could be extended to rejoin the UPRR corridor at 40th Street near Emeryville.

Oakland City Center Terminal Station Option This terminal station option would be in a deep subway configuration located next to the BART 12th/City Center Station. It would be located in the heart of Oakland's commercial area, and is proposed to have a direct concourse connection to the existing BART station. It would provide intermodal connections to four of the BART destinations: San Francisco, Richmond, Pittsburgh/Bay Point, and Fremont. Connections to existing AMTRAK service would not be available. A future extension could be via a bored tunnel section along 12th Street and a depressed section in Mandela Parkway to the existing UPRR corridor in Emeryville.

The route would again begin in an at-grade configuration in the railroad corridor near 17th Avenue and immediately transition to a cut-and-cover subway section beneath E. 12th Street to the vicinity of the Convention Center. The route would then use a bored tunnel beneath 12th Street to Broadway and the underground BART facilities. The tunnels are proposed to again be of minimal diameter to fit in the 80-foot street ROW. At this point, the BART line is three levels deep, with a concourse level, a two-track center platform level, and a single-track side platform at the lowest level. The high-speed train alignment is proposed to be directly below the BART structure, transitioning to a terminal station configuration to the north of BART and Broadway. This short section is anticipated to be mined, supporting BART in place.

The terminal station is assumed to be constructed from the surface utilizing a very deep excavation – approximately 90 feet. The two-track center platform level would be at the lowest level. Vertical circulation elements would rise to the concourse level with direct connections to the BART concourse and City Center. The vertical space between the platform and concourse level could be utilized for four levels of underground parking with possible connections to the underground City Center parking structure. The tracks would continue in a bored tunnel section an additional 2,700 feet for storage and turnback facilities to near I-980.

In the future, the line could be extended to rejoin the UPRR corridor at 40th Street near Emeryville. This extension could follow 12th Street and then via a long curved bored tunnel beneath local parks, residential and light industrial areas to the median of Mandela Parkway and the UPRR corridor.

B. I-880 ALIGNMENT – ENTIRE SEGMENT

The portion of I-880 from San Jose to Milpitas is of an older design and is scheduled for an upgrade in the near future. This highway has recently been reconstructed to modern standards through Milpitas to Fremont and is under design to U.S. 101. The section from Fremont to Oakland is older and has several substandard areas due to limited ROW availability. A potential solution would be an aerial structure from Diridon Station to Lenzen Avenue, where it would transition to a depressed section to a subway box under I-880 to an aerial solution in the median of the highway.

Potential midline station locations could be located in the South Alameda area near Mowry Avenue. An Oakland Coliseum/Airport Station would be located near Hegenberger Road on the east side of the highway. The line would continue to one of the four Oakland terminal options described above.

This alignment would start north of the Diridon Station in the vicinity of the proposed Lenzen maintenance facility for Caltrain at Lenzen Avenue. The section from Diridon Station to this location is anticipated to be aerial structure on the west side of existing and proposed Caltrain tracks. Caltrain has plans to expand the number of tracks in this area to fully utilize the available ROW. The high-speed train tracks are proposed to be on aerial structure passing over Lenzen Avenue, the UPRR connection to the former SPRR and the Coleman Avenue/Taylor Street intersection. The line would transition to a depressed section, passing beneath Hedding, Spring, and McKendrie Streets, leading to a subway section beneath I-880. This area has been cleared of most buildings for the airport clearance zones by the city of San Jose. The land is planned for low use green area. The line is assumed to emerge in the median of the future reconstructed I-880 west of North 1st Street. The route would transition to an aerial median configuration and continues in this manner to the end of this alignment in Oakland.

The highway corridor is in the process of being reconstructed to modern standards in the Milpitas area. Caltrans current standard for the median width is that it must provide a minimum 10-foot inside shoulder. This relates to a 22-foot median to include a two-foot wide concrete barrier. In areas of overhead bridge structures the support columns would encroach on this minimum width and would require a design exception.

The high-speed train tracks are assumed to be on an aerial structure, with an eight-foot wide column. This column would also require the shoulder width to be reduced. A design exception to Caltrans mandatory standards would need to be approved. Design exceptions are commonly applied for in the design process. During the engineering design phase, the spacing and width of the columns would need to be optimized to mitigate impacts on shoulder width.

For discussion purposes, I-880 between San Jose and Oakland has been divided into four segments described as follows:

San Jose U.S. 101 to the Route 237/I-880 Separation Current designs for this segment call for a 17-foot median and six lanes to be in place in 2004. However, according to the Caltrans planning section, Caltrans will be upgrading to a 22-foot median and eight lanes of traffic by the year 2020. The median appears sufficiently wide to support the construction of an eight-foot wide column for the aerial structure from San Jose to the SR-238 interchange, with an approved design exception. The new HOV flyover at the SR-237 interchange would require that the high-speed train aerial structure be approximately 2½ to 3 levels high (50 to 60 feet). The normal structure would require the structure to be at the second level (40 feet high) to pass over the bridges for the local roads. The structure would be lowered gradually wherever possible to the minimum height to clear the parallel highway lanes (20-feet high).

Route 237/I-880 Separation to Mission Boulevard Current designs for this segment call for a 22-foot median and eight lanes of traffic. The aerial structure would be at minimum height to clear the parallel highway lanes (20 feet high).

Mission Blvd to Hesperian Boulevard The existing freeway was recently upgraded with a 22-foot median and eight lanes of traffic. The alignment would need to pass over or go around the planned additional ramps for the Mission Boulevard interchange. This would place the high-speed train guideway at the fourth level, approximately 80 feet above grade or would require the

acquisition of additional commercial property and significant bent structure to transition the aerial structure to the side to go around the interchange. There are an additional 15 highway crossings where the guideway would need to cross at the second level – approximately 40 feet above grade level.

Hesperian Blvd to Broadway This segment has a substandard median of 12 feet. There are currently no advanced planning studies to upgrade this segment. The inclusion of and eight-foot diameter column would result in a two-foot inside shoulder, which is unacceptable and not a candidate for a design exception. The ROW width is substandard with high sound walls adjacent to the outside shoulders. The surrounding properties consist of residential, commercial and light industrial properties.

To make the alignment work for the six miles north of Hesperian Boulevard, the highway would need to be widened and ROW purchased, resulting in full parcel takes on one side of the highway. All existing structures passing over the I-880 highway would need to be extended. North of this area, the high-speed train tracks would again be on aerial structure in the median at the second level, and the highway would be reconstructed to current standards.

The alignment would transition to the east side of I-880 south of Hegenberger Road and remain on aerial structure to a possible station location between I-880 and South Coliseum Way. The station would consist of four tracks and two platforms with a concourse below. The route would transition back to a two track configuration and remain as aerial structure on the east side of the highway until it pass over the railroad tracks and transition to at-grade section between the railroad and BART. From there, the alignment would travel to one of the four possible terminal station locations.

For those portions of the alignment proposed to be constructed in the median of an active highway, close coordination will be required with Caltrans and some lane closures may be required during construction. Passing over the local roads would again require lane or road closures while erecting the aerial structure overhead.

In areas of sub-standard ROW width the entire highway would have to be reconstructed to create the required width in the median for the aerial support column. This would result in major construction issues of rebuilding bridge structures, sound walls and adjoining roadways.

Agreements would have to be negotiated with Caltrans to use their ROW for a high-speed train guideway. In areas of sub-standard ROW width, sufficient ROW would need to be purchased to create the required width in the median for the aerial support column. This would require the purchase of residential, commercial and light industrial properties. Additional ROW would need to be acquired for the Hegenberger Station.

C. I-880/HAYWARD ALIGNMENT

This subsegment would follow the I-880 alignment as described above to Fremont, where it would transition to follow the proposed BART alignment at Warm Springs to Union City and the Hayward branch. The alignment would be at-grade at Warm Springs and transition to a tunnel generally following parallel and adjacent to the proposed future BART alignment and then to the Hayward corridor via aerial structure at Union City. The UPRR Hayward branch is used by the UPRR for freight and by the intercity AMTRAK Capitol Corridor trains and extends from the Oakland Coliseum area to Fremont. The corridor is generally approximately 100 feet wide, with three industrial sidings. A possible solution would be mostly at-grade with either a subway or aerial solution in the areas of industrial sidings. The other option would be to buy the siding

industries or provide alternate delivery service. At the AMTRAK Station, pedestrian access would be revised to show either an over or underpass for AMTRAK passengers.

Potential midline stations could be located in Union City next to the existing BART Station or in Warm Springs at the planned future BART station. An Oakland Coliseum/Airport Station would be located near Hegenberger Road adjacent to the planned AMTRAK station and within the BART Station redevelopment site. The line would continue to one of the four Oakland terminal options described above.

The alignment would be identical to the I-880 alignment described above from San Jose to Mission Boulevard in Fremont. The route would then transition to the Hayward rail line via a tunnel beneath Fremont. Present design speeds for passenger trains along the Hayward branch vary from a top speed of 79 mph to a low of 60 mph near the Coliseum Station. There are few physical constraints along this line, and speeds of 125 to 150 should be possible.

At Mission Boulevard, the aerial structure would transition from the median to the east side of I-880 and across Mission Boulevard to the railroad corridor and future VTA/BART corridor. The high-speed tracks are proposed between the UPRR and future BART tracks. The UPRR and VTA are presently in negotiations to purchase this 80-foot wide ROW.

This width is sufficient to provide for two high-speed tracks and two BART tracks, with 21-foot separation. At present, the UPRR desires to sell less than the full ROW wanting to maintain as many tracks for the yard tracks as possible. The configuration would have to be modified after the final ROW determination is made. A BART Station is proposed at Warm Springs with a center platform. Maintaining the southbound BART track in a straight configuration and adjusting the northbound track to allow for the platform would permit high-speed train tracks between the UPRR and BART. The concourse for BART is presently assumed below the tracks. An optional high-speed train station could be located at this BART station and would require a four-track station. To minimize the additional ROW requirements for this location, the station configuration is assumed with express tracks on aerial structure above a center platform and the concourse below as a continuation of the BART concourse. This would minimize the ROW to 50 feet but would still require that the current planned BART alignment be shifted to the east by an equal amount.

From the Warm Springs Station to Washington Boulevard, the line would be at-grade between the UPRR and BART. The line would transition to a deep tunnel configuration before Paseo Padre Parkway and continue in this configuration below Fremont Central Park, the Fremont BART Station site, and the BART line to the UPRR tracks from Niles Junction. The line would pass over the flood control channel and be at-grade in the railroad corridor parallel to BART. This corridor is 80 feet wide from the flood control channel to Niles Road, and the use of the corridor is in transition. Two high-speed tracks are proposed along with two other tracks for either freight or commuter lines. The separation between high-speed train tracks and the other tracks would again be 21 feet.

North of Niles Road, the alignment would stay along the BART alignment, by-passing the intermodal terminal or to a four-track station configuration directly adjacent to the BART Station within a Union City Intermodal Facility. The concourse would be below at the same elevation as the BART concourse.

The high-speed train alignment would need to pass below BART near H Street and follow the railroad corridor at-grade along the Hayward branch, which passes below the BART and railroad

tracks in a subway box through the BART embankment. The alignment would turn north and drop into the Hayward corridor in an at-grade configuration.

The Hayward Branch is at-grade and a 100-foot wide UPRR corridor. Forty feet of this corridor would need to be purchased from the UPRR for the use by high-speed train. The other 60 feet would allow for two tracks for the UPRR and the AMTRAK Capitol Corridor trains, with additional room for a potential siding or third track.

At the existing AMTRAK Hayward Station near A Street, the high-speed tracks would shift slightly to the east to allow for the platform between the high-speed train and AMTRAK tracks. Access to the platform would be via an overhead pedestrian access or a subway access. The overhead could also provide access to A Street.

From A Street to the Oakland Coliseum Station, the route would be again at-grade. There are 10 existing at-grade highway crossings in the section from Fremont to Oakland. All of these would need to be grade separated for high-speed trains. Some are in the process of being grade separated by others.

The Oakland Coliseum/BART/Airport Station would be similar to the station described as part of the Mulford line Alignment, as would the section to 17th Avenue and the four optional Oakland terminal stations.

Agreements would need to be reached with Caltrans regarding the use of their ROW. Early coordination would be required with BART to allow for a high-speed train station at Warm Springs. The final ROW available from the UPRR near the Warm Springs Station needs to be determined and, if necessary, the high-speed train configuration modified to fit the available ROW.

D. I-880/HAYWARD BRANCH/FORMER WPRR ALIGNMENT (UNION CITY TO SAN LEANDRO)

This subsegment would follow the I-880/Hayward Branch alignment to Union City, where it would transition to follow the former WPRR. The former WPRR line follows the BART aerial structure and also passes beneath it twice. The UPRR has considered selling this line in the past. A possible solution would be aerial structure with short at-grade segments as it crosses below the BART structure. Potential midline stations could be located in Union City next to the existing BART Station or in Warm Springs at the future BART station. An Oakland Coliseum/Airport Station would be located near Hegenberger Road adjacent to the existing BART station. The line would continue to one of the four Oakland terminal options after passing beneath the BART structure.

The route will be similar to the I-880 alignment from Lenzen Avenue in San Jose to Mission Boulevard and similar to the I-880/Hayward alignment from Mission Boulevard to Niles Boulevard in Union City.

The route would be on aerial structure starting at Niles Boulevard and follow the former WPRR alignment all the way to the junction in Oakland with the main UPRR corridor near High Street. The existing speeds along this corridor are significantly lower than on the Hayward Branch or the Mulford line and require the alignment to pass below the BART structure twice as it changes from the east to the west side of BART. These crossings occur near I Street in Union City and just south of the San Leandro Creek.

The present BART line is at-grade at the Union City Station and on aerial structure just to the north to F Street. The alignment would cross beneath BART near G Street in an at-grade

configuration and continues at-grade to just south of the Hayward BART Station. The route would be aerial to just south of I-238, where it would again transition to at-grade to a point south of the Bayfair Station. It would then transition back to aerial through the Coliseum/Airport/BART Station to near 50th Avenue. At this point, it would passes beneath San Leandro Avenue in a short subway box segment to an at-grade configuration in the UPRR railroad corridor at High Street. The line would continue to a West Oakland terminal station Option as previously described.

The line would be constructed in a fairly narrow ROW adjacent to the BART aerial structure. Care would need to be taken in erecting the high-speed train aerial structure so as not to interfere with the BART operations. The ROW would need to be purchased in its entirety from the UPRR. All other issues are the same as for the I-880/Hayward/West Oakland Alignment.

E. MULFORD/NILES/HAYWARD ALIGNMENT

This route would be similar to the Mulford line from Santa Clara to the junction with the Niles subdivision in Newark. The route would turn east using the existing ROW, pass through Niles Junction and continue on the Hayward Branch. The existing passenger train speeds through this Niles connector area vary from a high of 79 mph to a low of 35 and 15 mph through the curves at either end of this corridor.

The corridor is 100 foot wide. Two tracks for UPRR/AMTRAK/ACE and two for high-speed trains could be arranged in this corridor with a minimum of 21 feet between the high-speed train and the other tracks. There are six at-grade highway crossings in this area with very close adjacent streets and residential properties. The alignment would transition from the aerial section on the Mulford line to a depressed trench at Central Avenue to Paseo Padre Parkway, where it would transition to an at-grade section and follow the Capitol Corridor route to Union City. At Decoto Road in Union City, the line would be similar to the Hayward Branch.

An Optional Union City high-speed train station could be located on the Niles connector at Peralta and Fremont Boulevard or at the intermodal terminal as described in the I-880/Hayward Branch/ West Oakland Alignment.

F. MULFORD/TUNNEL/HAYWARD ALIGNMENT

The route would be similar to the Mulford line from Santa Clara to the junction with the Niles subdivision in Newark. The line would then proceed via a long bored tunnel to the Hayward line in Union City and continue to Oakland as previously described in the I-880/Hayward/West Oakland Alignment. The bored tunnel would encounter high groundwater and gravel near the Union City intermodal area. The area above the tunnel is presently commercial and residential properties and vacant land. However, the vacant land is being planned for heavy commercial and residential development. The ROW would be a major, if not insurmountable issue by the time the high-speed train project will be developed.

G. MULFORD/NILES/WPRR ALIGNMENT

This Alignment would connect the subsegments from the following alignments: (1) Mulford, (2) Mulford/Niles/Hayward, and (3) I-880/Hayward.

H. MULFORD/TUNNEL/WPRR ALIGNMENT

This Alignment would connect the subsegments from the following alignments: (1) Mulford, (2) Mulford/Tunnel/WPRR, and (3) I-880/Hayward.

4.0 ALIGNMENT AND STATION EVALUATION

This Section evaluates, on a comparative basis, the various alignments and stations as described in Section 3.3 for each of the three major segments in the Bay Area-to-Merced corridor. Major differences between alignments and stations are highlighted and discussed. Alignments and station characteristics for which only minor variations are evident among the alignments and stations are not discussed. The Section is organized around the three major Bay Area-to-Merced corridor segments:

(1) Merced-to-San Jose,
(2) San Jose-to-San Francisco, and
(3) San Jose-to-Oakland.

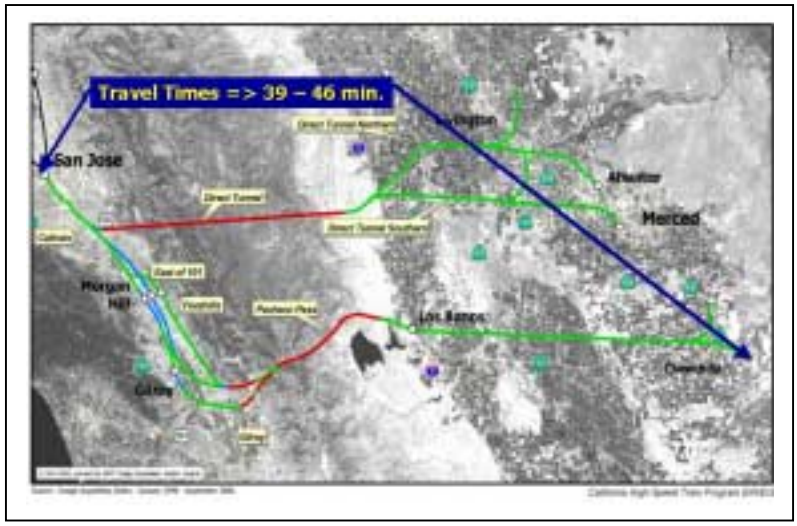
4.1 Merced-to-San Jose Segment

The following subsections compare various characteristics of the alignments and stations within the Merced-to-San Jose Segment. Summary statistics and characteristics are shown at the end of this section in Table 4.1-1 for the alignments and in Table 4.1-2 for the stations.

4.1.1 Maximize Ridership/Revenue Potential

A. TRAVEL TIME

Alignment Evaluation/Comparison: Express travel times from the Merced Area (near Chowchilla and SR-99) to the San Jose (Diridon) Station are similar. The lowest would be 39 minutes for the Direct Tunnel Southern, the Pacheco Pass/ East of 101, and the Pacheco Pass/ Foothills alignments. The highest travel time would be 46 minutes for the Pacheco Pass/ Gilroy/Caltrain Alignment. For local trains, the Direct Tunnel Southern Alignment, with a stop at a station in Merced, would save 11 minutes compared to the Pacheco Pass/Gilroy Alignment, with local stops in Los Banos and Gilroy.



The Pacheco Pass East of 101 and Foothills alignments would have travel times from Los Angeles to San Jose generally equivalent to the Merced Southern Direct Tunnel Alignment and three minutes faster than the Merced Northern Direct Tunnel Alignment. Local train service for the East of 101 and Foothills alignments, with stops in Los Banos and Morgan Hill, would be three to four minutes faster than the local service, with a stop in Merced, for the Southern Direct Tunnel Alignment, and would be one to two minutes faster than the Merced Northern Direct Tunnel Alignment – a minimal difference.

Significant differences exist among the alignments for travel times from Sacramento to the Bay Area. Both Direct Tunnel alignments would be approximately 28 minutes faster from Sacramento to San Jose than the Pacheco Pass/ Gilroy/Caltrain alignment, with a difference of 35 minutes for local trains. Operational cost savings would occur for this service, given that the Direct Tunnel alignments would be approximately 65 miles shorter than the Pacheco Pass/Gilroy Alignment, for example.

B. Length

Alignment Evaluation/Comparison: The Direct Tunnel alignments would be shorter than the Pacheco Pass alignments by 24 to 29 constructed miles, depending on the alignment. The Pacheco Pass Caltrain/Morgan Hill, East of 101, and Foothills Alignments would be shorter than the Gilroy alignment by three to four miles. Minimal differences in length exist between the Caltrain/Morgan Hill, East of 101, and Foothills alignments.

C. POPULATION/EMPLOYMENT CATCHMENT

Station Evaluation/Comparison: The Pacheco Pass alignments would have stations in Los Banos and Gilroy or Morgan Hill, while the Direct Tunnel alignments would bypass these stations. The Los Banos Station would provide service to residents in the Los Banos area, traveling to San Jose or Gilroy for business or travel. This would provide an alternative to driving over Pacheco Pass, although catchment numbers are relatively small for the Los Banos Station when compared to the population and employment numbers for other stations in the Bay Area-to-Merced corridor.

The Gilroy or Morgan Hill stations would serve as catchment stations for the growing population areas to south, including the Salinas/Monterey and Santa Cruz areas, thus yielding the one-million plus anticipated population and employment catchments as shown in Table 4.1-2.

4.1.2 Maximize Connectivity and Accessibility

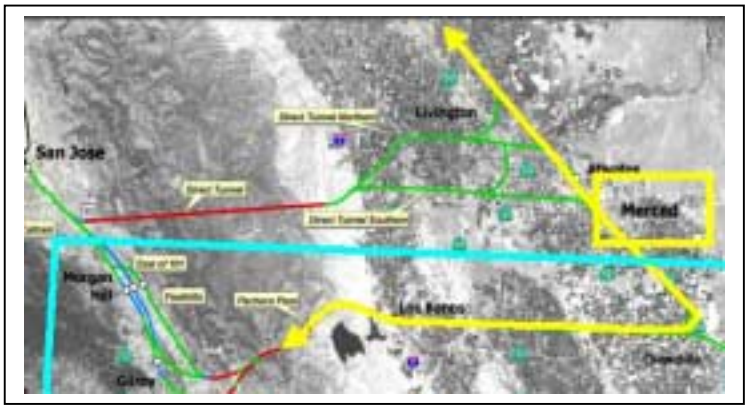
A. INTERMODAL CONNECTIONS

Station Evaluation/Comparison: The San Jose high-speed train station (Diridon) is evolving into one of the major intermodal facilities in the Western United States, with existing connections to Caltrain, Capital Corridor, and ACE commuter rail services, AMTRAK service, and VTA buses. The Vasona light rail system is currently under construction to the San Jose (Diridon) Station, and an extension of the BART system is currently under study and partially funded by a local sales tax. A high-speed train station at this location would provide extensive interconnectivity to these multiple modes.

The Gilroy or Morgan Hill stations on the Caltrain Alignments (Gilroy/Caltrain and Caltrain/Morgan Hill Alignments) would provide direct interconnections to Caltrain service. It is assumed that Caltrain would travel within the same corridor between Gilroy/Morgan Hill to San Jose and up the Peninsula. While the high-speed train service would be faster than the local Caltrain service between major stations, Caltrain is currently reviewing implementation of "baby bullet" trains to run from Gilroy to San Francisco at speeds up to 90 mph and with limited local stops. Connectivity to Caltrain service would require a bus shuttle for the Foothills or East of 101 Alignments.

The two Direct Tunnel alignments would place Merced on the Los Angeles-to-Bay Area train line (rather than the Sacramento-to-Bay Area line), providing more frequent service to Merced.

All of the Pacheco Pass alignment options would place Merced on the Sacramento-to-Bay Area high-speed train line, with less frequent service than the Los Angeles-to-Bay Area trains. As currently configured, the Pacheco Pass alignment options would also involve construction of tunnels, including a tunnel up to 13.5-mile (21.6 km) in length and one or two additional shorter tunnels. All Pacheco Pass alignments would provide high-speed train service to the Los Banos and the Gilroy or Morgan Hill areas. These areas would be bypassed by the Direct Tunnel alignments.



4.1.3 Minimize Operating and Capital Costs

A. LENGTH

Alignment Evaluation/Comparison: The Direct Tunnel alignments would be shorter than the Pacheco Pass alignments by 24 to 29 constructed miles, depending on the alignment. The Pacheco Caltrain/Morgan Hill, East of 101, and Foothills Alignments would be shorter than the Gilroy alignment by three to four miles. Minimal differences in length exist between the Caltrain/Morgan Hill, East of 101, and Foothills alignments. Operations from Los Angeles to San Jose should be less costly, therefore, for the Direct Tunnel alignments. Operational cost differences would occur, however, for the service from Sacramento to San Jose, given that the Direct Tunnel alignments would be approximately 65 miles shorter than the Pacheco Pass/Gilroy Alignment, for example, representing a potential major savings in the costs associated with vehicle miles traveled for this service.

The Direct tunnel alignments would also place the Merced Station on the Los Angeles to San Jose line, providing more frequent and direct service for local trains passing through the Merced area.

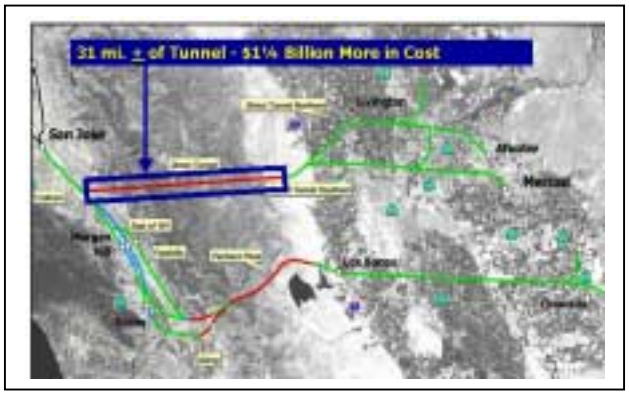
B. OPERATIONAL ISSUES

Alignment Evaluation/Comparison: Since all alignments in this segment would, for the most part, involve exclusive guideways with high-speed curves and grades, standard train operations would be expected. Some speed restrictions would exist for curves coming into the San Jose (Diridon) Station from the south and leaving to the north, but the train would be slowing to stop at this station as it enters and exits.

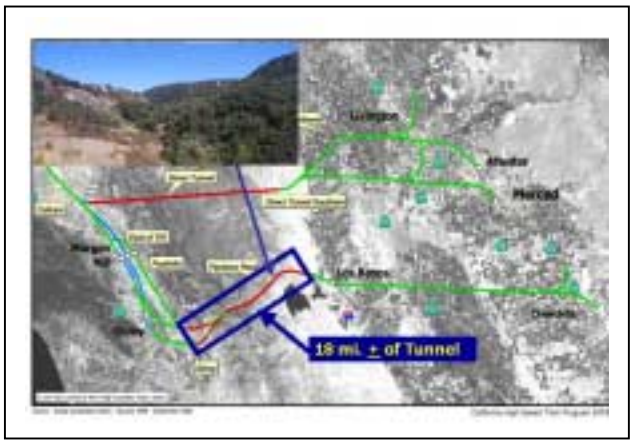
Station Evaluation/Comparison: As noted above, the San Jose (Diridon) Station would constitute a major transfer and destination location and is assumed as a stop for all trains – both express and local. Given the relatively small size of the Los Banos Station Catchment numbers, it is expected that this station would be bypassed by express trains and would receive more limited local service with higher headways (more time between trains). This service could be increased over time should demand dictate. Express trains are also expected to bypass the Gilroy or Morgan Hill stations, although more local service is anticipated for heavy demand periods – e.g., AM and PM commute periods. The Caltrain corridor Stations in Gilroy and Morgan Hill would offer direct transfer capability between Caltrain and high-speed trains, while the East of 101 and Foothills alignment stations would require a shuttle transfer.

C. CONSTRUCTION ISSUES

Alignment Evaluation/Comparison:



Tunnels: Highly variable soil types in many formations underlie both the Direct Tunnel and the Pacheco Pass alignments, as shown by a preliminary geological study. There are three active faults on the Direct Tunnel alignments and one on the Pacheco Pass alignments. Based on a preliminary geotechnical study of these alignments, it appears that a variety of tunneling techniques may be necessary. The Direct Tunnel alignments would involve construction of tunnels that are among the longest in the world (31 miles – 49.6 km) though mixed soil and geology types.



The Pacheco Pass alignments evaluated in previous Authority studies were designed to minimize the amount of tunneling. However, for this screening, an alignment was identified that that was lower in profile, allowing for an evaluation of reduced levels of disturbance on the surface, but resulting in approximately 18 miles of tunnel.

While this would minimize environmental impacts, it increases the length of tunneling. Vertical alignments (depths) for the Pacheco Pass alignments need to be further evaluated, given the potential major cost differences in higher versus lower profiles, in more short tunnels versus fewer longer tunnels, and in potential environmental impacts of surface construction across sensitive natural areas. It is clear that different assumptions for tunneling unit costs and the vertical profile for the Pacheco Pass alternatives could potentially lead to an even greater disparity of costs between the Direct Tunnel and Pacheco Pass alignments. Additional analysis is necessary to gain a better understanding of and more confidence in the appropriate tunneling approach (e.g., use of tunnel boring machine versus drill and blast techniques) and associated cost estimates.

Monterey Highway/Caltrain Corridor: For the corridor along Monterey Highway, the entire corridor would need to be reconfigured, involving maintenance of traffic issues for all transportation modes – highway, freight railroad, AMTRAK, and Caltrain. It is anticipated that the corridor would be reconstructed from east to west – first the highway, then the UPRR. High-speed train and new Caltrain tracks would then be built, with new grade separated station facilities. Support columns for existing bridges for the overpasses would have to be reconfigured under traffic. Utilities would need to be relocated to the new highway area, away from the UPRR. Major ROW purchases are expected alongside the east side of Monterey Highway, varying from 5 to 70 feet. At the southern end, this land is presently agricultural, with suburban residential more predominant at the northern end. Approximately nine feet would have to be purchased on the west side of the corridor at each Caltrain station location. This land is typically residential or commercial. Approximately 75 feet would have to be acquired through the quarry operation area, and quarry operations would have to be modified to allow for a widened trackway.

North of the Caltrain Tamien Station: Constructing an aerial structure between SR-87 and Caltrain would involve construction access issues and possible lane closures on SR-87. Between SR-87 and I-280, some homes may need to be acquired. The existing embankment would need to be widened to allow for high-speed train tracks, including short-rise walls if necessary. Residual lands existing after construction are assumed to be landscaped. Constructing over major and minor highways in this subsegment would involve temporary street closures, while the aerial guideway structure is constructed. Some light industrial land would need to be acquired between I-280 and the San Jose (Diridon) Station to allow for the aerial structure. Air rights would be needed above the San Jose Station.

Station Evaluation/Comparison: The Los Banos Station is expected to be situated between Henry Miller roadway and the San Luis Wasteway canal in an approximately 120-foot wide corridor of flat and vacant property. The canal would have to be protected during construction or possibly enclosed, depending on the final design of the station and parking facilities.

The platforms and tacks at the Diridon Station are currently planned to be reconfigured by others. With high-speed train tracks overhead, it would be beneficial to coordinate the track and platform locations to permit easy passenger transfer by continuous elevators serving the platforms, mezzanine, and underground connector. Constructing the San Jose (Diridon) high-speed train station above existing and operating tracks and platforms would involve close coordination with all railroad operators. Tracks would need to be taken out of service in a planned sequence to allow for overhead construction and support footings. The historic canopies could be temporarily removed and replaced over the new platform locations in a similar configuration.

Construction of the Gilroy and Morgan Hill stations on the Caltrain corridor would involve acquisition of adjacent commercial property and provision of safe passenger routes across Caltrain tracks. Commercial property would also be required for the Morgan Hill Station on the East of 101 Alignment. Property required for the Morgan Hill Station on the Pacheco Pass/Foothills Alignment would be more rural in nature.

Capital Cost:

Although shorter in length, the Direct Tunnel alignments are currently estimated to cost at least $1¼ billion more than the lowest cost Pacheco Pass alignment in the Foothills. The higher cost for the Direct Tunnel alignments is due largely to the longer tunnel and currently assumed unit cost per-mile for tunneling.

In addition, the Pacheco Pass alignments evaluated in previous Authority studies were designed to minimize the amount of tunneling. However, for this screening, an alignment was identified that that was lower in profile, allowing for an evaluation of reduced levels of disturbance on the surface, but resulting in approximately 18 miles of tunnel. While this would minimize environmental impacts, it increases the length of tunneling. Vertical alignments (depths) for the Pacheco Pass alignments need to be further evaluated, given the potential major cost differences in higher versus lower profiles, in more short tunnels versus fewer longer tunnels, and in potential environmental impacts of surface construction across sensitive natural areas. It is clear that different assumptions for tunneling unit costs and the vertical profile for the Pacheco Pass alternatives could potentially lead to an even greater disparity of costs between the Direct Tunnel and Pacheco Pass alignments. Additional analysis is necessary to gain a better understanding of and more confidence in the appropriate tunneling approach (e.g., use of tunnel boring machine versus drill and blast techniques) and associated cost estimates.

The Pacheco Pass/Foothills/Morgan Hill Alignment is the least costly of all alignments in this segment, primarily due to less tunneling and its shorter length compared to the other Pacheco Pass alignments. The Pacheco Pass/Caltrain/Morgan Hill Alignment is estimated to be about $200 million more, followed by the Pacheco Pass/Gilroy and the Pacheco Pass/East of 101 Alignment at about $300 million more.

Alignment Evaluation/Comparison: For comparative purposes, the alignments can be grouped into the Pacheco Pass vs. the Direct Tunnel alignments. These two groupings present major differences in terms of cost, travel time, and overall impacts and benefits, as evidenced by the information provided in Table 4.1-1.

The Direct Tunnel alignments would exhibit the following major characteristics, as compared to the Pacheco Pass alignments:

- Higher capital costs by between at least $1 ¼ Billion more as currently estimated,
- Shorter travel times for the Sacramento to San Jose service by 28 minutes for express service and 35 minutes for local service.
- Placement of the Merced Station on the Los Angeles to San Jose/San Francisco/Oakland line, providing improved direct local service from Merced to the Bay Area,
- Tunneling risks and fire/life/safety issues associated with longer tunnel construction and operations,

- Fewer construction and operational impacts of natural areas and habitat and threatened or endangered species.

- Substantially less impact on farmlands and floodplains.

A comparison of the characteristics of the two Direct Tunnel alignments illustrates the following:

- Constructed miles for the Northern Alignment would be slightly shorter in length by 0.6 miles, although it is estimated to cost somewhat more, due to the higher number of primary and secondary waterway, canal, and roadway crossings.

- The Southern alignment passes through a greater length of wetlands – approximately 4.4 miles, including the San Luis Wildlife Refuge, compared to the Northern alignment that would pass through an estimated 2.4 miles of wetland areas and passes beyond the limits of the Wildlife Refuge.

- For analysis purposes, it has been assumed that a low structure rather than a berm would be used as the alignment passes through major wetlands, e.g., in the Refuge area.

A comparison of the characteristics of the Pacheco Pass alignments illustrates the following:

- The construction costs including environmental mitigation and ROW acquisition are similar, with differences ranging near $300 million.

- Preliminary cost analyses indicate that the Pacheco Pass/Foothills/Caltrain Alignment is the least costly, while the Pacheco Pass/East of 101 is the most costly, primarily due to differences in alignment lengths and ROW acquisition costs.

- As currently defined, all of the Pacheco Pass alignments have similar tunnel lengths - roughly 18 miles. Changes in the gradient/profile of the Pacheco Pass alignments could introduce major cost savings, but may introduce an increase in adverse environmental effects. Changes in gradient/profile should be investigated in future analyses.

- The Pacheco Pass/Morgan Hill/Foothills/Caltrain Alignment has the least amount of aerial structure.

- The Pacheco Pass/Morgan Hill/Foothills/Caltrain Alignment has the greatest amount of property acquisition, much of it relatively undeveloped land, to accommodate cut and fill slopes.

- Given that the Pacheco/Gilroy/Caltrain Alignments is the longest at 120 miles, it exhibits the highest travel time of 46 minutes (express trains) between Merced and San Jose. The shorter Pacheco Pass Alignments – the Pacheco Pass/Caltrain/Morgan Hill, the East of 101, and the Foothills Alignments – exhibit 3 to 7 minute shorter express travel times.

- The longest length of sensitive habitat would be along the Pacheco Pass/Foothills and East of 101 alignments. The Direct Tunnel alignments exhibit substantially lower levels (approximately 40 percent less) than the Pacheco Pass alignments. The Direct Tunnel Southern Alignment would pass though a higher level and number of critical habitats compared to the Northern Alignment.

- Portions of all alignments would lie within areas subject to 100-year floods (see Figure S.2-1). The Gilroy, East of 101, and Caltrain to Morgan Hill alignments would include the longest lengths and percentages of alignment in the 100-year floodplain, with the least amount for the Direct Tunnel alignments, due to the 31-mile (49.6 km) tunnel segment. The Pacheco Pass/East of 101/Caltrain Alignment has the highest length of alignment in a 100-year floodplain and the highest number of floodplain and water resource crossings, followed closely by the Pacheco Pass/Gilroy/ Caltrain Alignment.

- Effects on farmlands (severance, loss of access, drainage, etc.) are expected for all of the alignments east of I-5 in the San Joaquin Valley (see Figure S.2-2). Given the length of alignment underground, less impact to unique and prime farmlands would occur for the Direct Tunnel alignments compared to the Pacheco Pass Alignments. The highest level of impacts to unique farmlands and farmlands of statewide importance would occur with the Pacheco Pass/Gilroy Alignment (see Figure S.2-2).

Station Evaluation/Comparison: As noted in the alignment descriptions, the Direct Tunnel alignments would only have stations at the two ends of the segment – Merced and San Jose. For the Direct Tunnel alignments, patrons in the Los Banos area would need to travel to Merced, and patrons in the Gilroy or Morgan Hill areas would need to travel to San Jose to catch a high-speed train. For the Gilroy or Morgan Hill area patrons, such access could be via Caltrain commuter rail to the San Jose (Diridon) Station, using local (or possibly "baby bullet") train service.

As shown in Table 4.1-2, the catchment area for the Los Banos Station encompasses a relatively limited number of population and employment, generally 10 percent of the other station catchment areas.

D. RIGHT-OF-WAY ISSUES/COST

Alignment Evaluation/Comparison: To minimize property impacts in the Central Valley, the main routes to the Bay Area would be located, to the extent possible, on existing ROW lines adjacent to or between roadways. Underpasses for separated agricultural lands are assumed to be provided.

High-speed train curves for the main route over Pacheco Pass to the Bay area from the Central Valley would bisect approximately two sections south of Chowchilla. One quarter of these sections appears to contain recent development, and the final alignment will need to be reviewed to minimize impacts to this development. The Direct Tunnel alignments would place the Merced Station adjacent to the Merced Municipal Airport, and some commercial property would be affected. The same applies for the Merced Northern station near Castle Air Force Base. The line north of these stations would bisect several sections at a diagonal, resulting in numerous parcel splits before the line aligns with the property lines.

The Sacramento-to-Bay Area connection would pass across the rural area at a diagonal to the roads and property lines, resulting in numerous parcel splits. Extra ROW would need to be purchased to mitigate this impact. Alternatively, parcel swaps with adjoining owners could be negotiated to minimize parcel splits and the need for underpasses.

The Direct Tunnel alignments would have significantly lower ROW costs and impacts compared to the Pacheco Pass alignments. The primary reason for the lower cost is that no ROW cost has been assumed for the tunnel portions of these alignments, although costs would be significantly lower, even with a nominal cost for an underground easement.

Each of the Pacheco Pass alignments has ROW cost and impacts in the Santa Clara Valley area. The alignments that follow the Caltrain/UPRR tracks would require property from Monterey Highway as well as the adjacent private property that currently is generally agricultural. The Foothills Alignment would require hillside property that is rapidly becoming developed. Sidehill cuts and embankments would widen the required ROW requirements. The East of 101 Alignment would require property acquisition and aerial easements along the east side of U.S. 101. This area is rapidly developing with commercial properties. The Gilroy Alignment would cut through a large agricultural area.

Station Evaluation/Comparison: The Direct Tunnel alignments have no stations between San Jose and Merced, so the cost and ROW impacts of these alignments are lower than those of the Pacheco Pass alignments. Each of the Pacheco Pass alignments has two stations – one in the Santa Clara valley, and one at Los Banos in the Central Valley. The Los Banos Station is assumed between Henry Miller Road and the San Luis Wasteway in presently vacant land. Additional adjacent ROW would need to be purchased to support the parking and station development. Depending on the station layout, the San Luis Wasteway might need to be enclosed throughout this section.

The Santa Clara Valley stations are all estimated as suburban stations, and the Los Banos Station is assumed to be a rural station. The Morgan Hill Station on the Foothills Alignment is assumed to be at-grade. The Morgan Hill or Gilroy station on the other alignments is assumed to be on aerial structure and will require additional ROW. A cost for the aerial portion and ROW is included for these stations.

The San Jose Station is assumed to be on an aerial structure over the existing tracks. A cost for the station structure has been added to the cost of the aerial guideway.

4.1.4 Maximize Compatibility with Existing and Planned Development

A. LAND USE COMPATIBILITY AND CONFLICTS

Alignment Evaluation/Comparison: A benefit of the Direct Tunnel alignments is that they would present no land use conflicts where they are below-grade. The widening of the existing Caltrain/UPRR rail corridor to accommodate high-speed trains would represent fewer land use conflicts than would the introduction of aerial or at-grade alignments along the U.S. 101 or in the foothills, although fewer land use conflicts (aside from property acquisitions) would be expected from an alignment along side of a freeway (U.S. 101 Alignment) than in the rolling hills, open fields and low-density residential areas present in the foothills (Foothills Alignment).

Station Evaluation/Comparison: Given its assumed location between a water wasteway and a rural road and given the extremely sparse development in the station area – mainly interstate commercial services – no land use conflicts are expected to occur with a Los Banos Station near I-5.

Current land uses adjoining the existing historic Gilroy train station are mainly commercial in nature. Locating a station to interconnect with the Caltrain services at the existing station

appears to represent highly complimentary and compatible land uses. Efficient design relationships should be provided to enable efficient and safe passage between the two Gilroy stations.

No land use conflict issues are apparent for a station in Morgan Hill on the Caltrain corridor. The station would be located in an area that is mainly commercial/industrial in nature. As with Gilroy, efficient linkages would need to be designed for passenger interconnections between high-speed train and Caltrain services.

Access to the Gilroy and Morgan Hill stations would be from Monterey Highway, thus providing convenient access for local residents but requiring passengers traveling from a distance to exit U.S. 101 and travel a few miles to the in-town stations.

A Morgan Hill Station along the U.S. 101 for the East of 101 Alignment would have excellent freeway access, but would not serve the center of Morgan Hill. The Foothills Alignment station in Morgan Hill would require passengers to travel along the eastern segment of Cochrane Road, which is more suburban in nature and away from the center of Morgan Hill, exhibiting a mix of residential and commercial uses.

A high-speed train station in San Jose (Diridon) would be completely supportive of San Jose's downtown strategic plan, which focuses redevelopment of the downtown more to the west and nearer to the station. Historic warehouse properties immediately to the west of the San Jose Station are currently being developed as residences, so some form of buffering would be required for an elevated station.

D. VISUAL QUALITY IMPACTS

Alignment Evaluation/Comparison: For all alignments, elevated structures will be required in the Merced Area for the high-speed lines to pass over each other, resulting in visual impacts in this area. The alignments in the Central Valley would typically be at-grade or on a berm or low structure, and should have a minimal affect on the visual landscaped, which is currently characterized by sparse rural development, farmlands, and natural wetland and wildlife habitat on flat lands. Crossing of the I-5 in aerial structure would be generally compatible with existing freeway structures.

Surface and aerial structures in Pacheco Pass will introduce a visual change in this natural environment, with effects similar to those associated with construction of SR-152, e.g., major cuts into the hillsides. The Pacheco Pass alignments would all cross the U.S. 101 and UPRR/Caltrain rail line in aerial structures, which should be generally consistent with the visual elements already present in the major transportation corridors. Addition of rail corridor along side the existing Caltrain/UPRR corridor would have a noticeable but generally minimal visual impact between Gilroy and southern San Jose, although portions of the alignment through Gilroy and Morgan Hill will be aerial, introducing a new visual element in these areas. An aerial structure next to U.S. 101 would introduce a new visual element in this area, but would be next to major freeway structures, making it visually less adverse than running in undeveloped, rural, or natural areas. Aerial and surface structures in the foothills would introduce a major new adverse visual element.

The aerial structure coming into the Caltrain corridor from the Direct Tunnel alignments would need to pass over U.S. 101 and a residential neighborhood, with associated visual impacts. However, the U.S. 101/SR-85 interchange structures are also in the vicinity. The Aerial structure

between the Caltrain ROW and SR-87 should be visually consistent with the rail and highway corridors.

The Structure over the San Carlos overcrossing in San Jose and the aerial San Jose (Diridon) Station represent major new visual elements for the areas south and immediately west of the historic Diridon Station.

Station Evaluation/Comparison: The high-speed train stations would present major new visual elements, particularly for the Morgan Hill Foothills Alignment and in San Jose (Diridon). Other stations would be generally compatible visually with their surroundings. The stations on the Caltrain ROW in Gilroy and Morgan Hill will be on aerial structure and are expected to have a second and third level for the platforms and passenger concourse. The concourse is needed to provide grade- separated access for patrons to the high-speed train platforms. The station would have four tracks and two platforms. It would be approximately 100-foot wide by 1,300 feet long, representing a major new visual element.

4.1.5 Minimize Impacts to Natural Resources

A. WATER RESOURCES

Alignment Evaluation/Comparison: All alignments in the Merced-to-San Jose Segment would cross the San Joaquin River, the California Aqueduct, creeks, irrigation canals, and major wetland areas. The Pacheco Pass alignments and the Direct Tunnel Southern Alignment would pass through the San Luis National Wildlife Refuge, which is characterized by major wetland areas, while the Direct Tunnel Northern Alignment would pass to the north of this Refuge. The Pacheco Pass alignments would cross the San Luis Wasteway but pass to the north of the O'Neil Forebay and San Luis Reservoir. As shown in Table 4.1-1, the Direct Tunnel alignments would cross substantially fewer water resources (27 crossings) compared to the Pacheco Pass alignments (70-78 crossings). Structures passing over or intruding into these waterways would need to designed so as to minimize impacts to these waters.

Station Evaluation/Comparison: With perhaps the exception of the Los Banos Station, which lies next to the San Luis Wasteway, major adverse impacts to water resources are not anticipated for stations in the Merced-to-San Jose Segment.

B. FLOODPLAIN IMPACTS

Alignment Evaluation/Comparison: Based on the statewide GIS database, portions of all alignments would lie within areas subject to 100-year floods, including:

- Portions of the Direct Tunnel Southern Alignment in the Merced Area,
- Portions of the Direct Tunnel, Southern Alignment in the area east of I-5,
- All of the Pacheco Pass Alignments east of Los Banos,
- All of the Pacheco Pass Alignments east of the Pass, and
- The Pacheco Pass/Gilroy Alignment south and east of Gilroy.

Overall as shown in Table 4.1-1, the Pacheco Pass Gilroy, East of 101, and Caltrain to Morgan Hill alignments would include the longest lengths and percentages of alignment in the 100-year floodplain. Among the Pacheco Pass alignments, the Foothills Alignment would exhibit the least impact to floodplain areas, due to its location in the foothills. The least amount of alignment within a 100-year floodplain would be for the Direct Tunnel alignments, due to its 31-mile tunnel

segment, although the Southern Direct Tunnel Alignment would pass through a greater amount of area subject to flooding than the Northern Direct Tunnel Alignment.

Station Evaluation/Comparison: The Los Banos Station on the Pacheco Pass alignments would be in an area subject to 100-year floods. For the Pacheco Pass/Gilroy Alignment, the Gilroy Station would be in an area subject to 100-year floods.

Station platforms and tracks would be designed at an elevation above 100-year flood levels. To the extent possible, station access and ancillary facilities, would be designed at an elevation above 100-year flood levels or to withstand flooding.

B. THREATENED AND ENDANGERED SPECIES IMPACTS

Alignment Evaluation/Comparison: All alignments would pass through natural habitat, wetlands, and pristine mountainous terrain. Based on the statewide GIS database, examples of threatened and endangered species that would be affected by the alignments are:

- California tiger salamander – all alignments
- San Joaquin kit fox – all alignments
- Swainsons' Hawk – Direct Tunnel alignments (Northern and Southern)
- Delta Button Celery – Direct Tunnel Alignment (Southern)
- Valley Elderberry Longhorn Beetle – Direct Tunnel Alignment (Southern)
- Giant Garter Snake – East of 101 and Gilroy alignments, and
- Bay Checkerspot Butterfly – Foothills and East of 101 alignments.

In terms of the length of alignment within sensitive habitat, the highest levels occur with the Pacheco Pass/Foothills and East of 101 alignments. The Direct Tunnel alignments exhibit substantially lower levels (approximately 40 percent less) than the Pacheco Pass alignments. The Direct Tunnel Southern Alignment would pass though a higher level and number of critical habitats compared to the Northern Alignment.

Station Evaluation/Comparison: The statewide GIS database identifies two threatened/ endangered species impacts for the stations in this segment: (1) the San Joaquin Kit Fox for the Los Banos Station, and (2) the California Tiger Salamander for the Morgan Hill Station (Foothills Alignment) and San Jose (Diridon) Station, although it must be recognized that the San Jose Station is in a highly urbanized area.

4.1.6 Minimize Impacts to Social and Economic Resources

A. ENVIRONMENTAL JUSTICE IMPACTS (DEMOGRAPHICS)

Alignment Evaluation/Comparison: According to the statewide GIS data, census block groups with minority populations greater than 50 percent through which alignments would pass include:

- Merced area – all alignments
- Near Los Banos – Pacheco Pass alignments
- Gilroy and Morgan Hill areas – Pacheco Pass alignments
- Southern portion of San Jose – all alignments

The most critical impacts to minorities appears to be the potential need to acquire properties in the southern San Jose neighborhood to the west of SR-87 on all alignments.

While all alignments may have adverse impacts (visual, noise, etc.) on minority populations, the provision of high-speed train service should offer beneficial effects for all populations within the Bay Area-to-Merced corridor.

Station Evaluation/Comparison: None of the stations in the Merced-to-San Jose Segment is expected to have disproportionate adverse effects on minority populations, and these populations should realize beneficial effects from the provision of high-speed train service.

E. FARMLAND IMPACTS

Alignment Evaluation/Comparison: Based on the statewide GIS data, effects on farmlands (severance, loss of access, drainage, etc.) are expected for all of the alignments east of I-5 in the San Joaquin Valley portion of all alignments. As shown in Table 4.1-1, less impact to unique and prime farmlands would occur for the Direct Tunnel alignments compared to the Pacheco Pass Alignments. The highest level of impacts to unique farmlands and farmlands of statewide importance would occur with the Pacheco Pass/Gilroy Alignment.

Station Evaluation/Comparison: According to the statewide GIS database, the Los Banos and Morgan Hill (East of 101) could affect prime farmland areas, although these impacts are not deemed to be severe given their proposed locations.

4.1.7 Minimize Impacts to Cultural Resources

A. CULTURAL RESOURCES IMPACTS

Alignment Evaluation/Comparison: The existing Gilroy and Diridon train stations are historic and on the National Register of Historic Places. Other cultural resources were not identified for this segment, although an affirmative search was not undertaken.

Station Evaluation/Comparison: While the new high-speed train stations near the existing historic Gilroy and San Jose stations would introduce major new visual elements, the high-speed train stations would enhance the use of both stations by expanding their multi-modal transportation functions.

B. PARKS AND RECREATION/WILDLIFE REFUGE IMPACTS

Alignment Evaluation/Comparison: The Pacheco Pass alignments and the Direct Tunnel (Southern) Alignment would pass through the San Luis National Wildlife Refuge. Consistent with Section 4(f) of the Department of Transportation Act of 1966, additional analyses and design will need to be undertaken to determine if there are prudent alternate alignment locations that would avoid this wildlife or if design elements (e.g., use of a low aerial structure) can be applied to minimize impacts to this wildlife refuge.

Station Evaluation/Comparison: No impacts are expected to occur on parks, recreation, or wildlife refuges for any of the stations in the Merced-to-San Jose Segment.

4.1.8 Maximize Avoidance of Areas with Geologic and Soils Constraints

A. SOILS/SLOPE CONSTRAINTS

Alignment Evaluation/Comparison: Based on the statewide GIS information, the Direct Tunnel alignments would pass through the least amount of highly erodible and high shrink/swell soils.

This appears to be due primarily to the shorter length of the Direct Tunnel alignments. The Direct Tunnel alignments would pass through a larger amount of area characterized by steep slopes greater than nine percent, although the alignment in these steep slope areas would primarily be in tunnel. All high-speed train facilities would be designed taking into account existing soil, groundwater, and geologic conditions in the area.

B. SEISMIC CONSTRAINTS

Alignment Evaluation/Comparison: The Direct Tunnel alignments would cross several active and potentially active faults in tunnel including the San Joaquin Fault, the Ortigalita Fault, the southern extension of the Greenville Fault trend, the Calaveras Fault zone, the Evergreen Fault, the Silver Creek Fault, and the Piercy Fault. The tunnels for the Pacheco Pass alignments would cross the Ortigalita Fault in tunnel. All alignments would cross the Silver Creek Faults in an aerial alignment, except the Gilroy Alignment would pass these faults in an at-grade section. All high-speed train facilities would be designed taking into account existing soil, groundwater, and geologic conditions in the area and to withstand maximum credible earthquakes from fault activity in the area.

Table 4.1-1
Bay Area-to-Merced Corridor -- High-Speed Train Alignment Evaluation Matrix
Merced-to-San Jose Segment

Evaluation Criteria	Alignment					
	Pacheco Pass / Gilroy / Caltrain	Pacheco Pass / Caltrain / Morgan Hill	Pacheco Pass / East of 101 / Morgan Hill / Caltrain	Pacheco Pass / Foothills / Morgan Hill / Caltrain	Merced Southern / Direct Tunnel / Caltrain	Merced Northern / Direct Tunnel / Caltrain
MAXIMIZE RIDERSHIP/REVENUE POTENTIAL.						
TRAVEL TIME (Merced to San Jose)	3	3	4	4	5	5
Express Service [a]	46 min.	43 min.	39 min.	39 min.	39 min.	42 min.
Local Service [b]	58 min.	55 min.	52 min.	51 min.	47 min.	50 min.
LENGTH (Constructed Miles)	3	3	3	3	5	5
	120.3 miles (193.7 km)	116.7 miles (187.9 Km)	117.0 miles (188.4 Km)	116.1 miles (186.9 Km)	92.0 miles (148.1 km)	91.4 miles (147.2 km)
MINIMIZE OPERATING AND CAPITAL COSTS.						
LENGTH	3	3	3	3	5	5
	120.3 miles (193.7 km)	116.7 miles (187.9 Km)	117.0 miles (188.4 Km)	116.1 miles (186.9 Km)	92.0 miles (148.1 km)	91.4 miles (147.2 km)
OPERATIONAL ISSUES	2				4	
	• Two additional stations • More overall system length – additional operating cost • Merced on Los Angeles to Bay Area rail line. • Additional definition is needed for operating speeds & ventilation & fire/life/safety requirements for long tunnel segments.				• Two fewer stations • Less overall system length – less operating cost • Merced not on Los Angeles to Bay Area rail line. • Additional definition is needed for operating speeds & ventilation & fire/life/safety requirements for long tunnel segments.	
	• Alignments on separate guideways that meet high-speed train standards.					
CONSTRUCTION ISSUES	4	4	4	2	2	
	• Need to determine type of structure for wetland areas • For tunnels: - Highly variable soil types & faults - Need to determine best tunneling approach - Ventilation/fire/life/safety issues • Major cuts required for Foothills Alignment. • Monterey Highway corridor would need to be reconstructed to accommodate highway, Caltrain, UPRR, & high-speed train needs. Maintenance of vehicular & train traffic will be critical. • Constructing aerial structure and stations in Gilroy and Morgan Hill over or near active railroad tracks will require staging, detours and additional ROW				• Type of structure for wetland areas • For tunnels: - Long tunnels - Highly variable soil types - Multiple faults - Determine best tunneling approach - Ventilation/fire/life/safety issues	
CAPITAL COST	4	4	4	4	2	2
	Approx. $200 Million more than Pacheco Pass/Foothills		Approx. $200 Million more than Pacheco Pass/Foothills	Least Costly	Estimated at 1 ¼ Billion more costly than Pacheco Pass alignments	

Evaluation Criteria	Alignment					
	Pacheco Pass/ Gilroy/ Caltrain	Pacheco Pass/ Caltrain/ Morgan Hill	Pacheco Pass/East of 101/ Morgan Hill /Caltrain	Pacheco Pass/ Foothills/ Morgan Hill /Caltrain	Merced Southern/ Direct Tunnel/ Caltrain	Merced Northern/ Direct Tunnel/ Caltrain
RIGHT-OF-WAY ISSUES	2	2	3	3	5	
	• Farmland east of I-5 & south of Gilroy. • Properties around Gilroy Station & Caltrain corridor for UPRR & highway relocation.	• Farmland east of I-5. • Properties around Morgan Hill Station & Caltrain corridor for UPRR & highway relocation.	• Farmland east of I-5. • Properties for Morgan Hill Station & commercial property along Freeway. • Properties along Caltrain corridor for UPRR & highway relocation.	• Farmland east of I-5. • Properties for Morgan Hill Station & and residential an open space properties in foothills • Properties along Caltrain corridor for UPRR & highway relocation.	• Least impact due to long tunnel • Farmland north and east of Merced • Properties near 101 and crossing of SR-87	
MAXIMIZE COMPATIBILITY WITH EXISTING AND PLANNED DEVELOPMENT.						
LAND USE COMPATIBILITY AND CONFLICTS	3		2	1	4	
	• Alignment generally compatible with rail & highway corridors.			• Rail alignment less compatible with rural/ residential land uses in foothills	• Fewer land use compatibility issues due to long tunnel	
VISUAL QUALITY IMPACTS	2	3	3	1	4	
	• Tunnel segments minimize visual impacts. • Surface & aerial sections in Pass create visual change in natural environment • Although on berm or structure to Gilroy, visual effects on flat valley (farmlands, rural, & wetland/ natural habitat	• Tunnel segments minimize visual impacts. • Surface and aerial sections in Pass create visual change in natural environment. Impacts less severe than Gilroy alignment.	• Tunnel segments minimize visual impacts. • Surface and aerial sections in the Pass create visual change in natural environment. • Impacts less severe than Gilroy alignment.	• Tunnel segments minimize visual impacts. • Surface and aerial sections in Pass create visual change in natural environment. • Travels through natural foothills introducing new major visual element.	• Area in tunnel will minimize visual impacts. • Even though on low berm or structure, will have visual effects on flat San Joaquin Valley characterized by farmlands, sparse rural development, & wetlands/ natural habitat areas. • New structures crossing U.S. 101 & SR-87 will be a new visual element.	
MINIMIZE IMPACTS TO NATURAL RESOURCES.						
WATER RESOURCES	1	2	1	2	5	5
# of crossing of alignments	77	65	78	70	27	27
FLOODPLAIN IMPACTS	1	2	2	2	5	5
# of 100 yr. floodplain crossings	40	36	51	40	21	16
Total length of alignment (meters)	256,432	250,640	251,000	249,500	176,316	178,474
Length of alignment within 100 year floodplain	31,023	29,432	32,514	24,269	14,780	10,367
Percent of total length within floodplain	12.1%	11.7%	13.0%	9.7%	8.4%	5.8%

Evaluation Criteria	Alignment					
	Pacheco Pass/ Gilroy/ Caltrain	Pacheco Pass/ Caltrain/ Morgan Hill	Pacheco Pass/East of 101/ Morgan Hill /Caltrain	Pacheco Pass/ Foothills/ Morgan Hill /Caltrain	Merced Southern/ Direct Tunnel/ Caltrain	Merced Northern/ Direct Tunnel/ Caltrain
THREATENED & ENDANGERED SPECIES IMPACTS	2	2	1	1	5	5
# of threatened & endangered species (per CNDDB)	**3**	**4**	**5**	**5**	**5**	**3**
# Federal endangered	2	3	3	3	2	2
# Federal threatened	1	1	2	2	1	0
# State endangered	0	1	1	0	1	0
# State endangered	2	2	2	2	2	2
Area of Alignment within Sensitive Habitat (per CNDDB)	**1,053,770**	**1,065,527**	**1,210,685**	**1,309,607**	**788,199**	**766,289**
MINIMIZE IMPACTS TO SOCIAL AND ECONOMIC RESOURCES.						
ENVIRONMENTAL JUSTICE IMPACTS (Demographics)	4	5	5	5	5	5
# block groups >50 percent minority	38	32	31	26	27	30
# block groups >50 percent low-Income	0	0	0	0	0	0
Potentially affected minority population	7,462	4,399	4,097	4,020	4,341	4,251
Potentially affected low-income population	0	0	0	0	0	0
FARMLAND IMPACTS	1	3	3	3	5	5
Area of prime farmland (square meters)	1,718,152	1,723,213	1,673,135	1,280,980	418,636	491,598
Area of unique farmland (square meters)	456,833	456,833	454,120	473,200	36,291	92,857
Area of farmland of statewide importance (square meters)	855,365	657,124	649,175	632,244	748,199	660,366
MINIMIZE IMPACTS TO CULTURAL RESOURCES.						
CULTURAL RESOURCES IMPACTS	3	4	4	4	4	4
# of known resources within ROW	2 historic train stations	1 historic train station	1 historic train station	1 historic train station	1 historic train station	1 historic train station
PARKS & RECREATION/ WILDLIFE REFUGE IMPACTS	2	3	3	3	1	2
	• Passes through San Luis National Wildlife Refuge Complex & major wetland areas on both sides of Pacheco Pass				• Passes through San Luis National Wildlife Refuge Complex & major wetland areas	• Passes through major wetland areas
Maximize Avoidance of Areas with Geologic and Soils Constraints.						
SOILS/SLOPE CONSTRAINTS	3	3	3	3	5	5
Area of highly erodible soils (square meters)	3,636,050	3,865,027	3,769,173	3,865,027	1,363,058	2,369,798
Area of high shrink/swell soils (square meters)	2,404,320	2,223,381	2,263,452	2,223,381	1,013,721	1,154,333
Area of steep slopes - greater the 9 percent including tunnel segments (square meters)	523,902	533,132	546,791	584,658	832,481	626,369

Evaluation Criteria	Alignment					
	Pacheco Pass / Gilroy / Caltrain	Pacheco Pass / Caltrain / Morgan Hill	Pacheco Pass / East of 101 / Morgan Hill / Caltrain	Pacheco Pass / Foothills / Morgan Hill / Caltrain	Merced Southern / Direct Tunnel / Caltrain	Merced Northern / Direct Tunnel / Caltrain
SEISMIC CONSTRAINTS	5	3			1	
	• Cross Ortigalita Fault in tunnel. • Cross Silver Creek & Calaveras faults at-grade.	• Cross Ortigalita Fault in tunnel. • Cross Silver Creek and Calaveras faults in aerial.			• Cross San Joaquin, Ortigalita, Greenville, Piercy, and Calaveras faults in tunnel.	
	• All high-speed train facilities would be designed taking into account existing soil, groundwater, and geologic conditions in the area and to withstand maximum credible earthquakes from fault activity in the area.					

Notes: [a] Express trains would not stop in Merced but would travel non-stop to San Jose
[b] Local trains would stop in Merced and at Gilroy or Morgan Hill stations for the Pacheco Pass alignments

1 2 3 4 5

Least Favorable **Most Favorable**

Table 4.1-2
Bay Area-to-Merced Corridor -- High-Speed Train Station Evaluation Matrix
Merced-to-San Jose Segment

EVALUATION CRITERIA	Stations			
	Los Banos	**Gilroy**	**Morgan Hill**	**San Jose (Diridon)**
	Pacheco Pass Alignments Only	**Gilroy Alignment Only**	**Caltrain East of 101 Foothills**	**All Alignments**
MAXIMIZE RIDERSHIP/REVENUE POTENTIAL.				
POPULATION/ EMPLOYMENT CATCHMENT (YEAR 2020)	1	4	4	5
	• 9,696 employment • 87,596 population	• 1,048,458 employment • 1,016,375 population	• 1,048,458 employment • 1,016,375 population	• 905,644 employment • 366,338 population • Assumes Gilroy or Morgan Hill & Santa Clara Station. • For Direct Tunnel alignments, Gilroy or Morgan Hill total would need to be added to San Jose • Santa Clara Station total would need to be added to San Jose if Santa Clara Station not assumed
MAXIMIZE CONNECTIVITY AND ACCESSIBILITY.				
INTERMODAL CONNECTIONS	1	3	4 3 2	5
	• Freeway (I-5)	• Caltrain commuter rail • U.S. 101	• Caltrain Morgan Hill Station provides direct connection to Caltrain • East of 101 & Foothills Morgan Hill stations would not provide direct connections to Caltrain • East of 101 Morgan Hill Station has direct freeway access	• Caltrain commuter rail • ACE commuter rail • Capital commuter rail • Amtrak • VTA buses • VTA light rail • Possible BART
MINIMIZE OPERATING AND CAPITAL COSTS.				
OPERATIONAL ISSUES	2	3	3 5 5	2
	• None	• Grade separated pedestrian connections needed to platforms & Caltrain.	• Grade separated pedestrian connection to platforms and Caltrain • None	• Station would feed both San Francisco & Oakland lines. Track designations needed. • Grade separated pedestrian connections needed to platforms & Caltrain.

EVALUATION CRITERIA	Stations			
	Los Banos	Gilroy	Morgan Hill	San Jose (Diridon)
	Pacheco Pass Alignments Only	Gilroy Alignment Only	Caltrain East of 101 Foothills	All Alignments
			• None	
CONSTRUCTION ISSUES	5	3	3 5 5	2
	• None	• Constructing over or near active railroad tracks	• Constructing over or near active railroad tracks • None • None	• Constructing over active railroad platforms and tracks
CAPITAL COST	Least Costly	Moderate Costs	Moderate Costs	Most Costly
RIGHT-OF-WAY ISSUES/COST	5	3	3 3 4	5
	• Currently vacant land	• Commercial property required	• Commercial property • Commercial property • Rural property	• No ROW cost assumed
MAXIMIZE COMPATIBILITY WITH EXISTING AND PLANNED DEVELOPMENT.				
LAND USE COMPATIBILITY AND CONFLICTS	5	5	5 5 3	5
	• No conflicts	• No apparent conflicts • Design high-speed train station to function efficiently with Caltrain station	• No apparent conflicts in Morgan Hill • Design high-speed train station to function efficiently with Caltrain station • No apparent conflicts • More suburban in nature with residential	• Compatible with City of San Jose's strategic downtown plan. • Buffer needed between aerial high-speed train station & the new residential west of the station.
VISUAL QUALITY IMPACTS	5	4	4 5 1	3
	• Minimal impacts	• Large aerial structure in Gilroy and farmland embankment south of Gilroy	• Large aerial structure in Morgan Hill • Minimal impacts • Adverse impacts	• Moderate impacts due to size and residential to the west
MINIMIZE IMPACTS TO NATURAL RESOURCES.				
WATER RESOURCES	3	5		
	• Potential impacts to San Luis Waterway	• No impacts anticipated		
FLOODPLAIN IMPACTS	1	1	5	5

EVALUATION CRITERIA	Stations			
	Los Banos	**Gilroy**	**Morgan Hill**	**San Jose (Diridon)**
	Pacheco Pass Alignments Only	**Gilroy Alignment Only**	**Caltrain East of 101 Foothills**	**All Alignments**
	• Located in 100-year floodplain	• Located in 100-year floodplain	• Not in floodplain	• Not in floodplain
THREATENED & ENDANGERED SPECIES IMPACTS	1	5	5 5 1	4
	• San Joaquin Kit Fox	• None identified by statewide GIS	• None identified by statewide GIS • None identified by statewide GIS • California Tiger Salamander	• California Tiger Salamander • Highly urban area
MINIMIZE IMPACTS TO SOCIAL AND ECONOMIC RESOURCES.				
ENVIRONMENTAL JUSTICE IMPACTS (Demographics)	• Disproportionate impacts not anticipated for any station			
FARMLAND IMPACTS	5	5	5	5
	• In Prime Farmland Area although effects minimal due to station location.	• Not in farmland area	• Not in farmland area • In Prime Farmland Area although effects minimal due to station location. • Not in farmland area	• Not in farmland area
MINIMIZE IMPACTS TO CULTURAL RESOURCES.				
CULTURAL RESOURCES IMPACTS	3	4	4	4
	• San Jose (Diridon) Station • Gilroy Station	• San Jose (Diridon) Station	• San Jose (Diridon) Station	• San Jose (Diridon) Station
PARKS & RECREATION / WILDLIFE REFUGE IMPACTS	• No impacts to parks, recreation, or wildlife refuge areas for stations in this segment.			
GEOLOGIC AND SOILS CONSTRAINTS	• All high-speed train facilities would be designed taking into account existing soil, groundwater, and geologic conditions in the area and to withstand maximum credible earthquakes from fault activity in the area.			

1 2 3 4 5

Least Favorable **Most Favorable**

4.2 San Jose-to-San Francisco Segment

The following sections compare various characteristics of the alignments and stations within the San Jose-to-San Francisco Segment. Summary statistics and characteristics are provided at the end of this section Table 4.2-1 for the alignments and in Table 4.2-2 for the stations.

4.2.1 Maximize Ridership/Revenue Potential

A. TRAVEL TIME

Alignment Evaluation/Comparison: Travel times are similar (28 – 30 min.) for the Caltrain and U.S. 101 exclusive guideway alignments. The U.S. 101 travel time is about 1.5-2.0 minutes longer than the Caltrain exclusive guideway travel time, due mainly to curves at Burlingame and Santa Clara that restrict speed. For each alignment, the travel time from the 4th and King terminal is also about 1.5-2.0 minutes shorter than from the Transbay Terminal, due to the shorter length.

The travel time for the Caltrain Shared Use Four-track Station Option is estimated to be about five minutes longer than the Caltrain corridor exclusive guideway. This is due to the assumed lower maximum authorized speed from Millbrae to San Jose with shared use. The travel time for the Caltrain Basic Service Option could be as low as the Four-track Station Option if no local Caltrain trains were to impede intercity trains. To the extent that train schedules affect the speed, the travel time would be longer.

B. LENGTH

Alignment Evaluation/Comparison: Lengths of the Caltrain corridor and the U.S. 101 corridor alignments are also essentially the same, between 47 and 48 miles. The U.S. 101 alignment is 0.2 miles longer than the Caltrain alignment. The 4th and King terminal alignments are 1.6 miles shorter than the exclusive guideways that terminate at the Transbay Terminal. The Caltrain Shared Use options are about 0.15 miles shorter than the Caltrain exclusive guideway due to the difference in length approaching the Transbay Terminal.

C. POPULATION/EMPLOYMENT CATCHMENT

Station Evaluation/Comparison: As shown in Table 4.2-2, the largest employment and population catchment in the San Jose-to-San Francisco Segment would occur in downtown San Francisco at either the 4th and King or the Transbay Terminal station locations, given the high density of employment and residents in this urban area. (See Section 4.1.1-C for a discussion of he San Jose [Diridon] Station catchment.) With its strategic location in Silicon Valley, the optional station at Santa Clara exhibits a large population and employment catchment, even assuming a station in San Jose (Diridon). A Santa Clara station could also serve the San Jose International Airport.

A high-speed train station in Millbrae exhibits the next highest level of employment and population, principally due to its strategic location near the San Francisco International Airport. With its lower density development and employment centers, the Redwood City and Palo Alto stations exhibit the lowest levels of employment and population catchment in the San Jose-to-San Francisco Segment.

4.2.2 Maximize Connectivity and Accessibility

A. INTERMODAL CONNECTIONS

Station Evaluation/Comparison: The optional high-speed train station in Santa Clara would provide transit access to a number of modes, including the Caltrain, ACE, and Capitol Corridor commuter trains, VTA buses, and a possible future people mover connection to the San Jose Airport. (See Section 4.1.2 for a discussion of he San Jose [Diridon] Station intermodal connections.) The Redwood City and Palo Alto stations would provide access to Caltrain commuter rail services for the Caltrain Alignment. The Redwood City Station would provide freeway access for the U.S. 101 alignment. A station in Millbrae would provide access to the San Francisco International Airport as well as Samtrans buses. A Millbrae Station on the U.S. 101 Alignment would also have immediate access to the freeway.

The Peninsula Commute Joint Powers Board and the City and County of San Francisco are currently planning for a new Transbay Terminal in the heart of the City's Financial District/South of Market Area at First and Mission streets. Included in this proposal is new multi-modal Transbay Terminal, an extension of Caltrain 1.5 miles from its current terminus at 4th and King to the basement of the new terminal, and over seven million square feet of transit oriented development in the area surrounding the new terminal. This facility would serve as a major multi-modal center for the employment center of San Francisco, with direct access to multiple modes of transit including AC transit, MUNI, and Greyhound buses, Caltrain commuter rail, paratransit services, and a possible underground connection to a BART station on Market Street. The optional high-speed train station location for San Francisco would be at the current Caltrain station and yard at 4th and King streets. This location has access to MUNI Metro and buses, the I-280 Freeway, and Caltrain commuter rail.

4.2.3 Minimize Operating and Capital Costs

A. LENGTH

Alignment Evaluation/Comparison: As noted above, the lengths of the Caltrain corridor and the U.S. 101 corridor alignments are essentially the same. Thus, alignment lengths should not affect high-speed train operations. It is estimated that the U.S. 101 alignment would cost between $200 to $400 million more than the Caltrain dedicated guideway option. Both would involve extensive use of aerial structures and have some segments of tunnel. The U.S. 101 corridor would involve more property acquisition, primarily because there are segments along the freeway where there is no available space. In addition, the freeway has substandard features such as median and shoulders in many places. Any room that might be available for high-speed train facilities in these areas could be presumed to be used by Caltrans to upgrade the freeway.

The costs of the alignments terminating either at 4th and King or the Transbay Terminal are likewise similar. The cost of the tunnel under Mission Bay and the Embarcadero to the Transbay terminal are offset by the need for additional ROW along 7th Street and the need for a terminal on structure at 4th and King. The costs of the Caltrain Shared Use options are substantially lower – approximately $1 billion less for the Basic Service Option and $400 million less for the Four-track Station Option – than the exclusive guideway alignments. Estimated capital costs of the Caltrain and U.S. 101 exclusive guideway alignments are similar, with between $200 to $400 million more for the U.S. 101 alignments. Both exclusive guideway alignments would involve extensive use of aerial structures, with some tunnel segments. It is estimated that there will be more right-of-way (ROW) and cost required for the U.S. 101 corridor than for Caltrain, given that

there is little space available for expansion adjacent to the Freeway. In addition, the freeway has substandard features (e.g., medians and shoulders) in many places, and it is assumed that any room that might be available for high-speed train facilities likely would be used by Caltrans to upgrade the freeway in these areas. By contrast, there appears to be space available adjacent to the Caltrain ROW to construct an aerial structure partially overhanging the tracks and partially over adjacent streets where they are present.

Estimated capital costs for the Caltrain Shared Use options are substantially lower – approximately $1 billion less for the Basic Service Option and $400 less million for the Four-track Station Option. This assumes that the high-speed train program would pay for generally ½ the costs for electrifying the Caltrain corridor and ½ the costs for an extension of Caltrain to the Transbay Terminal.

For the Basic Service Option, additional significant costs would be for grade separation of 47 of the existing grade crossings and the construction of pedestrian overpasses at the Caltrain stations. For the Four-track Station Option, there would be additional costs for aerial structures and a tunnel, but these costs are somewhat offset by the reduced number of Caltrain grade separations that would need to be constructed for high-speed trains.

C. OPERATIONAL ISSUES

Alignment Evaluation/Comparison: For both the U.S. 101 and Caltrain corridor exclusive guideway options, maximum speeds would be constrained by the existing curves on each of these corridors. Operations would be generally the same on either alignment.

High-speed train operations under the Caltrain Shared Use options would need to be coordinated and integrated with Caltrain and freight service. There would be a potential for high-speed train delays or reduced service frequency due to the need to share the tracks. The Four-track Station Option would reduce this potential by eliminating the possibility of local Caltrains stopped at stations slowing or blocking high-speed trains. However, maximum authorized speed on the Caltrain tracks is not expected to be as high as would be possible with an exclusive guideway, so travel times are expected to be longer.

Station Evaluation/Comparison: The possible Redwood City station location on the U.S. 101 Alignment is currently a go-kart and family entertainment area with relatively little development. On the Caltrain corridor, the ROW at the Redwood City location is only 40 feet wide, and there is commercial development on both sides of the station. The station site at Palo Alto previously had four tracks, so there is potentially enough ROW above the Caltrain tracks for a high-speed train station.

The San Francisco International Airport station on the Caltrain corridor could be constructed on an aerial structure above the existing Caltrain Millbrae Station, and next to the BART terminal currently under construction. Some private property would need to be acquired. Access to the airport would be via BART. On the U.S. 101 corridor, the station would be located at-grade on the west side of the freeway, north of Millbrae Avenue. Access to the airport would be less convenient than the Caltrain corridor Millbrae Station, even with the station being located close to the airport.

The major station issue with respect to the Peninsula exclusive guideway alignments would appear to be the location of the San Francisco terminal. It does not appear that an alignment with stations at both Mission Bay and downtown is feasible for the exclusive guideway options. The alignments, either along the Caltrain corridor or U.S. 101, that terminate at 4th and King, are

estimated to cost about $50 million less (which is a relatively small difference at this level of analysis) than those that terminate at the Transbay Terminal. Travel times to/from 4th and King are shorter by one to two minutes than to/from the Transbay Terminal, which is relatively insignificant, and travel to/from downtown to 4th and King via surface transportation would take much longer than by the train. Current plans under review for a new Transbay Terminal include tracks and platforms to serve high-speed train service in the basement of the planned multi-modal facility.

The Caltrain Shared Use options -- Basic Service or the Four-Track Station -- would allow a station at both 4th and King and at a new Transbay Terminal, if the proposed Caltrain extension and new downtown terminal are implemented. The provision of two stations in San Francisco likely would create greater flexibility for high-speed train operations in the City.

For both the separate and Shared Use options along the Caltrain corridor, coordination would need to occur with Caltrain regarding station operations, use of common and separate facilities, passenger flows, and other physical and operating relationships. For all alignment leading to a new Transbay Terminal, coordination would need to occur with the owner/operator of the terminal regarding integration of the high-speed train program into Transbay Terminal operations. Similarly, coordination would need to occur with Caltrain for high-speed train operations through the yard and station at 4th and King under the Shared Use options and for operations of an aerial station over the Caltrain Yard for the separate use options.

D. CONSTRUCTION ISSUES

Alignment Evaluation/Comparison: Both the Caltrain and U.S. 101 corridor exclusive guideway alignments have similar construction issues. These involve constructing an aerial guideway adjacent to and above very busy and active existing transportation facilities while maintaining traffic, either highway or rail. Both Caltrain and Caltrans have very stringent requirements with respect to interruptions of service for construction. This means that detours for freeway traffic and shooflys for train service will be required. In addition, there will be restrictions on hours when construction will be allowed adjacent to active roadways or tracks. Nighttime and weekend work will be required. This will increase costs and construction duration. Nighttime work near residential areas may not be possible or may require mitigation.

In addition to Caltrain requirements, the Federal Railroad Administration (FRA) has regulations for Roadway Worker protection on construction adjacent to active railroad tracks. These regulations require flaggers and watchers and other procedures to protect workers.

Construction of below-grade segments on each corridor will involve issues such as utility relocation and potential disposal of hazardous materials. Additional ROW will be needed where the aerial guideway transitions to below grade subway or tunnel.

Construction of the tunnel in San Francisco to the Transbay Terminal site from 17th Street will be particularly difficult. Most of the tunnel will need to be constructed using compressed air techniques in very soft ground. This is very time consuming and costly, and there are potential risks of blowouts.

Construction of the grade separations that are included in the Caltrain Shared Use options would involve substantial property acquisition, severance damages and relocation. Adjacent streets will most likely need to be reconfigured with consequent impacts to local traffic. Extensive utility reconstruction, especially for gravity sewers, can be expected for any below grade (underpasses or undercrossings) solutions.

Station Evaluation/Comparison: For the exclusive use options, stations along the U.S. 101 corridor should be easier to construct than those along the Caltrain corridor. All of the stations on the U.S. 101 corridor would be located adjacent to but off the freeway ROW. The station at Redwood City would likely be on aerial structure, but could be partially at grade or on embankment. The station in Millbrae would be at grade and relatively easier to construct.

All proposed separate use stations on the Caltrain corridor would be on aerial structures above or immediately adjacent to the active railroad tracks. These would be more difficult and time consuming to construct than those along the U.S. 101 corridor.

The 4th and King terminal station would need to be constructed above either the existing Caltrain yard/station or the proposed yard if the Caltrain downtown terminal extension is constructed. This construction would need to be staged around yard and train operations. By contrast, there would be very little construction involved for high-speed train service at the proposed new Transbay Terminal, given that the proposed new Transbay Terminal project is being designed to accommodate high-speed train service.

E. CAPITAL COST

Alignment Evaluation/Comparison:

It is estimated that the U.S. 101 alignment would cost between $200 to $400 million more than the Caltrain dedicated guideway option. Both exclusive guideway alignments would involve extensive use of aerial structures, with some tunnel segments. It is estimated that there will be more right-of-way (ROW) and cost required for the U.S. 101 corridor than for Caltrain, given that there is little space available for expansion adjacent to the Freeway. In addition, the freeway has substandard features (e.g., medians and shoulders) in many places, and it is assumed that any room that might be available for high-speed train facilities likely would be used by Caltrans to upgrade the freeway in these areas. By contrast, there appears to be space available adjacent to the Caltrain ROW to construct an aerial structure partially overhanging the tracks and partially over adjacent streets where they are present.

Estimated capital costs for the Caltrain Shared Use options are substantially lower – approximately $1 billion less for the Basic Service Option and $400 less million for the Four-track Station Option. This assumes that the high-speed train program would pay for generally ½ the costs for electrifying the Caltrain corridor and ½ the costs for an extension of Caltrain to the Transbay Terminal.

For the Basic Service Option, additional significant costs would be for grade separation of 47 of the existing grade crossings and the construction of pedestrian overpasses at the Caltrain stations. For the Four-track Station Option, there would be additional costs for aerial structures and a tunnel, but these costs are somewhat offset by the reduced number of Caltrain grade separations that would need to be constructed for high-speed trains.

Station Evaluation/Comparison: All of the mid-line stations on the Caltrain corridor exclusive guideway and the U.S. 101 corridor have similar costs. All were estimated as urban stations. The capital costs assumed in this screening include ½ the costs for the Caltrain Downtown Extension. The 4th and King terminal has been estimated as an urban terminal, with an additional amount added for the terminal structure above the Caltrain yard.

F. RIGHT-OF-WAY ISSUES/COST

Alignment Evaluation/Comparison: The Caltrain and U.S. 101 exclusive guideway alignments are very similar, with each requiring construction of an aerial guideway in a densely populated and developed area without sufficient ROW available. However, it is estimated that there will be considerably more ROW (and cost) required for the U.S. 101 corridor than for the Caltrain corridor. The main reason for this is that there is very little space available adjacent to the U.S. 101 Freeway for expansion. In some areas, such as Redwood City and San Mateo, there are frontage roads immediately adjacent to the freeway on both sides. In these areas, any widening of the freeway for a guideway in the median or adjacent to the freeway would result in loss of access to fronting properties. Consequently, complete parcels would need to be acquired.

By contrast, there appears to be space available adjacent to the Caltrain ROW to construct an aerial structure partially overhanging the tracks and partially over adjacent streets where they are present. Slivers of property would need to be acquired in areas where the Caltrain ROW is less than 100 feet wide. Complete parcels or excess property would have to be acquired to compensate for severance in many areas, similar to the U.S. 101 corridor, but it does not appear to be as extensive.

At this stage of the project, the same unit cost has been applied for all ROW. It is likely that the unit cost of some of the properties along the U.S. 101 corridor may be less than along the Caltrain corridor. However, the total cost of ROW for the U.S. 101 corridor is still expected to be significantly greater than for the Caltrain corridor.

Station Evaluation/Comparison: ROW would need to be acquired for stations along the U.S. 101 corridor at Redwood City and Millbrae. The area that appears to suitable for a station in Redwood City is a go-kart and family fun center and is largely undeveloped, as is the station site at Millbrae along the U.S. 101 corridor.

On the Caltrain corridor, property acquisition or an aerial easement would be needed at the Redwood City site, where the station could be constructed above a parking lot. At Palo Alto, it appears that the station could be constructed entirely within Caltrain ROW, though site development might require additional property. Some private property might need to be acquired at the Millbrae Station west of Caltrain for the high-speed train station and guideway.

Air right costs have been assumed for the aerial station over the Caltrain yard and station at 4th and King streets. The approach to the 4th and King terminal will also require acquisition of property along the south (west) side of 7th Street.

4.2.4 Maximize Compatibility with Existing and Planned Development

A. LAND USE COMPATIBILITY AND CONFLICTS

Alignment Evaluation/Comparison: A major portion of the Caltrain corridor passes through industrial areas, but there are critical locations where the ROW passes through principally residential land uses. The corridor also passes through suburban town centers, oftentimes with development immediately adjacent to the rail line (e.g., San Mateo, Redwood City).

The U.S. 101 Alignment is generally more commercial than the Caltrain corridor, but it also has numerous segments of residential uses near or immediately adjacent to the freeway, typically behind a freeway noise wall. The aerial portions of the separate use alignments on the Caltrain and U.S. 101 corridor could be incompatible with the residential portions of these alignments,

depending upon their design and environmental mitigation characteristics. The 47 grade separations required for the Caltrain corridor Shared Use Alignment would introduce critical design and land use issues.

Station Evaluation/Comparison:

The Caltrain corridor stations in Redwood City, Palo Alto, Millbrae all would be in suburban town centers, characterized mainly by commercial development. The Shared Use options would be generally consistent with and complementary to these town centers, although necessary grade separations in these centers would involve land acquisition and relocation of uses as well as reconfiguration of the street system. The ultimate design of the grade separations would affect the degree of land use conflict for these town centers.

The separate use option on the Caltrain corridor would entail development of a major four-track structure over the Caltrain ROW in the town centers, with the potential for critical visual and shade/shadow impacts and the possible creation of a barrier to the continuity of land use and design in these suburban centers. The optional Caltrain corridor station at Santa Clara would be generally consistent with the commercial and industrial character of the area, but would need to take into account the historic designation of the existing Santa Clara Station.

U.S. 101 stations in Redwood City and Millbrae would be more compatible with the surrounding land uses, which are mainly commercial. Vehicular access from the freeway for the U.S. 101 corridor stations would be better compared to the vehicular access for the Caltrain corridor stations. Thus, traffic impacts for the U.S. 101 Alignment stations would be less disruptive than the vehicles traveling to the suburban town centers for the Caltrain corridor stations. Additionally, it appears that the provision of parking facilities at U.S. 101 Alignment station sites would be less disruptive to adjoining land uses, as compared to the Caltrain corridor station sites.

The aerial station for the separate use options (for both the U.S. 101 and Caltrain Alignments) in the City of San Francisco over the 4th and King site would be compatible with the Caltrain yard and station over which it would be located, although residential land uses are currently being developed in this area as part of the Mission Bay development, and residential lofts currently exist near the existing Caltrain facility.

B. VISUAL QUALITY IMPACTS

Alignment Evaluation/Comparison:

The separate use options for both the U.S. 101 and Caltrain corridor options would introduce a major new visual element along these major transportation corridors. Such facilities could have critical visual impacts (intrusion/shade/shadow) on the residential portions for both of these alignments.

Introduction of the elevated structure could also have adverse impacts on the suburban town centers along the Caltrain corridor. Although the structure would generally be in a commercial area in these centers, it could represent a barrier for land use and urban design in these areas. The Caltrain corridor Shared Use Option would have substantially fewer visual impacts, compared to the Caltrain Separate Use Alignment, although visual impacts would occur at locations where grade separations would need to be constructed, depending in part on the design of such separations.

Station Evaluation/Comparison: Given the assumption of a station structure on a box over the Caltrain ROW for the Caltrain corridor Separate Use Alignment, major visual impacts could occur at the Palo Alto, Redwood City, and Millbrae stations, particularly for the Historic Palo Alto and Millbrae stations. The stations could yield visual, shade/shadow impacts and serve as a barrier to the land use and design in these suburban town centers. Development of an aerial station at the 4th and King location over the existing Caltrain yard and station in San Francisco for the Separate Use options (both U.S. 101 and Caltrain) would introduce a new visual element into this area, which would be generally compatible with the existing Yard/station. However, residential land uses are currently being developed as part of the Mission Bay community near this station site.

4.2.5 Minimize Impacts to Natural Resources

A. WATER RESOURCES

Alignment Evaluation/Comparison:

The Caltrain corridor alignments would cross several creeks including: Llagas, Little Llagas, Fisher, Los Gatos, San Tomas Aquino, Saratoga, Calabazas, Wolf, Stevens, Permanente, Adobe, Barron, Matadero, San Francisquito, Cordilleras, Pulgas, Belmont, Laurel, San Mateo, Sanchez, Mills, and Colma creeks. It would also cross the Guadalupe River. It would pass near the San Francisco Bay in the northern portion of the alignment, and would therefore come under BCDC review.

The U.S. 101 alignment would cross several creeks including: San Tomas Aquino, Calabazas, Stevens, Drystone, Permanente, Adobe, Barron, Matadero, San Francisquito, Cordilleras, Redwood, San Mateo, Sanchez, Mills, Colma Creeks. It would also cross the following canals, a slough and a drainage ditch: Seale Wooster, Matadero, Sterling Canals, the Phelps Slough and a drainage ditch (south of Haddon). It would pass near the San Francisco Bay in the northern portion of the alignment and near the salt evaporators in Redwood City and Palo Alto and near the Belmont Slough, and would therefore come under BCDC review.

Structures passing over or intruding into these waterways would need to designed so as to minimize impacts to these waters.

Station Evaluation/Comparison: None of the stations would affect major waterways.

C. FLOODPLAIN IMPACTS

Alignment Evaluation/Comparison: Based on the statewide GIS database, portions of all alignments would lie within areas subject to 100-year floods, including:

- Palo Alto Area near bay – U.S. 101 Alignment
- Redwood City Area near Bay – U.S. 101 Alignment
- South of San Francisco Airport – Burlingame area – both Alignments
- Bayshore Area – both alignments

Overall, as indicated by the statewide GIS and as shown in Table 4.2-1, the length of alignment within the floodplain is somewhat longer for the Caltrain corridor than for the U.S. 101 corridor.

Station Evaluation/Comparison: For both the Caltrain and U.S. 101 alignments, the Millbrae stations would be subject to 100-year floods. The Redwood City Station for the U.S. 101 Alignment would be subject to 100-year floods. Station platforms and tracks would be designed

at an elevation above 100-year flood levels. To the extent possible, station access and ancillary facilities, would be designed at an elevation above 100-year flood levels or to withstand flooding.

D. THREATENED AND ENDANGERED SPECIES IMPACTS

Alignment Evaluation/Comparison: Based on information in the statewide GIS system, possible impacts could occur to threatened and endangered species for all alignments in the San Jose-to-San Francisco Segment. Examples of threatened and endangered species that may be affected include:

- For both alignments: California Tiger Salamander, Myrtles Silverspot, California Clapper Rail, and Beach Layia, and \
- For the U.S. 101 Alignment: Western Snowy Plover, Salt –Marsh Harvest Mouse

Particular care will need to be taken, particularly for those portions of all alignments that pass near the bay, to protect to the extent possible wildlife species and habitat.

Station Evaluation/Comparison: According to statewide GIS information, possible threatened and endangered species that could be affected in the station areas include the California Clapper Rail in the Millbrae Station area.

4.2.6 Minimize Impacts to Social and Economic Resources

A. ENVIRONMENTAL JUSTICE IMPACTS (DEMOGRAPHICS)

Alignment Evaluation/Comparison: As shown in Table 4.2-1, major demographic differences in terms of minority or low-income populations are not apparent among the San Jose-to San Francisco alignments. Based on the statewide GIS information, minority populations exist along both alignments north of Santa Clara Station, in the Palo Alto area, and in the southern portion of San Francisco County.

Station Evaluation/Comparison: According to the statewide GIS database, minority populations are present near the Redwood City and Palo Alto stations along the Caltrain corridor and near the Millbrae stations for both the U.S. 101 and the Caltrain corridor options. However, given their locations, none of the stations in the Merced-to-San Jose Segment is expected to have disproportionate adverse effects on minority populations, and these populations should realize beneficial effects from the provision of high-speed train service.

B. FARMLAND IMPACTS

Alignment Evaluation/Comparison: No farmland impacts are expected for either the U.S. 101 or the Caltrain corridor alignments.

Station Evaluation/Comparison: None of the stations in the San Jose-to-San Francisco Segment would be located on prime farmland.

4.2.7 Minimize Impacts to Cultural Resources

A. CULTURAL RESOURCES IMPACTS

Alignment Evaluation/Comparison: Six historic train stations exist along the Caltrain corridor, including: Santa Clara, Palo Alto, Menlo Park, San Carlos, Burlingame, and Millbrae. A separate

use options along this corridor would have more severe impacts on this stations than would the Shared Use options.

An affirmative search was not undertaken for cultural resources along the U.S. 101 corridor, although the statewide GIS system includes three historic sites The Transbay Terminal is currently on the National Register as a contributing feature to the historic Bay Bridge.

Station Evaluation/Comparison: Historic Caltrain corridor train stations are listed above. These stations would be most adversely affected by the Caltrain Separate Use Alignment.

B. PARKS & RECREATION/WILDLIFE REFUGE IMPACTS

Alignment Evaluation/Comparison: The U.S. 101 Alignment would potentially pass through or near the following parklands: Kelley Park (Menlo Park), Marina Ball Park (Redwood City), Laguna Vista Park (San Mateo), Fiesta Meadows Park (San Mateo), Parkside Park (San Mateo), San Mateo Municipal Golf Course, Coyote Point Recreation Area (San Mateo), Bayside Park (Millbrae), Bayside Manor Park (Millbrae), Marino Vista Park (Millbrae), 7th Avenue Park (San Bruno), and 7th Walnut Park (San Bruno). The CalTrain corridor Alignment would pass though El Palo Alto Park. Consistent with Section 4(f) of the Department of Transportation Act of 1966, additional analyses and design will need to be undertaken to determine if there are prudent alternate alignment locations that would avoid these parklands or if design elements can be applied that would minimize impacts to these parklands.

Station Evaluation/Comparison: None of the potential stations would be located in parklands for wildlife refuge areas.

4.2.8 Maximize Avoidance of Areas with Geologic and Soils Constraints

A. SOILS/SLOPE CONSTRAINTS

Alignment Evaluation/Comparison: According to the statewide GIS information, the Caltrain corridor alignments would pass through more highly erodible and shrink/swell soils as compared to the U.S. 101 Alignment, as shown on Table 4.2-1. None of the alignments would be in areas of steep slopes (greater than 9 percent). All alignments would be designed taking into account existing soil, groundwater, and geologic conditions in the area.

B. SEISMIC CONSTRAINTS

Alignment Evaluation/Comparison: All Alignments in the San Jose-to-San Francisco Segment would cross the San Bruno Fault. The San Andreas Fault lies to west of both the Caltrain and U.S. 101 corridors. All high-speed train facilities would be designed taking into account existing soil, groundwater, and geologic conditions in the area and to withstand maximum credible earthquakes from fault activity in the area.

Table 4.2- 1
Bay Area-to-Merced Corridor -- High-Speed Train Alignment Evaluation Matrix
San Jose-to-San Francisco Segment

OBJECTIVE	Alignments					
	U.S. 101 (Exclusive Guideway)		Caltrain (Exclusive Guideway)		Caltrain (Shared Use)	
	Transbay Terminal Station	4th & King Terminal Station	Transbay Terminal Station	4th & King Terminal Station	Basic Service Option w/Grade Separations	Four-track Station Option
Maximize Ridership/Revenue Potential						
TRAVEL TIME	5	5	5	5	4	4
Express	31 min.	30 min.	30 min.	28 min.	35 min. without track capacity constraints	35 min.
Local	39 min.	37 min.	37 min.	36 min.	41 min. without track capacity constraints	41 min.
LENGTH	5	5	5	5	5	5
	48.4 mi. (77.9 Km.)	47.2 mi. (76.0 Km.)	48.2 mi. (77.6 Km.)	47.0 mi. (75.7 Km.)	48.0 mi. (77.3 Km)	48.0 mi. (77.3 Km)
Minimize Operating and Capital Costs.						
LENGTH	5	5	5	5	5	5
	48.4 mi. (77.9Km.)	47.2 mi. (76.0 Km.)	48.2 mi. (77.6 Km.)	47.0 mi. (75.7 Km.)	48.0 mi. (77.3 Km)	48.0 mi. (77.3 Km)
OPERATIONAL ISSUES	5	5	5	5	3	4
	• Some speed restrictions due to curves.	• Some speed restrictions due to curves.	• Some speed restrictions due to curves.	• Some speed restrictions due to curves.	• Track capacity constraints due to shared use • Need to optimize commuter & high-speed train schedules • Safety issues at 2 & 3-track stations	• Track capacity constraints due to shared use • Need to optimize commuter & high-speed train schedules

OBJECTIVE	Alignments					
	U.S. 101 (Exclusive Guideway)		Caltrain (Exclusive Guideway)		Caltrain (Shared Use)	
	Transbay Terminal Station	4th & King Terminal Station	Transbay Terminal Station	4th & King Terminal Station	Basic Service Option w/Grade Separations	Four-track Station Option
CONSTRUCTION ISSUES	1	2	1	2	5	4
	• Construction adjacent to major freeway. • Stage construction, detours, nighttime work required. • Soft-ground tunneling to reach Transbay Terminal.	• Construction adjacent to major freeway. • Staged construction, detours, nighttime work required. • Terminal on aerial structure above active Caltrain yard & station.	• Construction adjacent to & above active railroad. • Staged construction, detours, nighttime work required. • Soft-ground tunneling to reach Transbay Terminal	• Construction adjacent to & above active railroad. • Staged construction, detours, nighttime work required. • Terminal on aerial structure above active Caltrain yard & station	• Construction of grade separations will require staged construction, shoo-flys, detours, & nighttime work.	• Construction of grade separations will require staged construction, shoo-flys, detours, & nighttime work. • Additional aerial structures adjacent to & above active railroad will require staged construction, detours, & nighttime work.
CAPITAL COST	1		2		5	3
	• Highest cost • Aerial structure • Major ROW costs		• High cost • $300 Million less than U.S. 101 • Aerial structure • Major ROW costs		• Lowest cost • Approx. $1 Billion less than U.S. 101 Exclusive Guideway • Uses existing infrastructure	• Low cost • Approx. 400 Mil. less than U.S. 101 Exclusive Guideway • Uses existing infrastructure
					• Assumes ½ cost of Caltrain Electrification & ½ cost of Caltrain San Francisco Downtown Extension	
RIGHT-OF-WAY ISSUES/COST	1		2	2	5	4
	• Mostly commercial and industrial. • Major ROW costs		• Mostly commercial & residential. Less ROW costs		• Commercial, residential & industrial properties adjacent to railroad at roads to be grade separated.	• Commercial, residential & industrial properties adjacent to railroad at roads to be grade separated. • Bypass tracks take additional ROW

OBJECTIVE	Alignments					
	U.S. 101 (Exclusive Guideway)		Caltrain (Exclusive Guideway)		Caltrain (Shared Use)	
	Transbay Terminal Station	4th & King Terminal Station	Transbay Terminal Station	4th & King Terminal Station	Basic Service Option w/Grade Separations	Four-track Station Option
LAND USE COMPATIBILITY AND CONFLICTS	2		1		4	
	• Generally commercial with numerous segments residential (typically behind sound walls) • Arial portion could be incompatible with residential development		• Generally industrial with numerous segments of residential • Passes through multiple suburban town centers • Arial portion could be incompatible with residential development		• Generally industrial with numerous segments of residential • Passes through multiple suburban town centers • Critical land use & design issues associated with grade separations	
VISUAL QUALITY IMPACTS	1				3	
	• Major New Visual Element – impacts to residential developments along freeway and Caltrain corridor				• Impacts from grade separations – sensitive design critical	
WATER RESOURCES	1	1	4	4	4	4
# of crossings of alignment	27	27	19	19	19	19
FLOODPLAIN IMPACTS	4	4	4	4	4	4
# of 100 yr. floodplain crossings	31	31	25	25	25	25
Length of alignment within 100 yr. floodplain	12,331	12,331	14,048	14,048	14,048	14,048
Percent of total length within floodplain	18.1%	18.1%	20.1%	20.1%	20.1%	20.1%
THREATENED & ENDANGERED SPECIES IMPACTS	2	2	4	4	4	4
# of threatened & endangered species (per CNDDB)	9	9	4	4	4	4
# Federal endangered	7	7	3	3	3	3
# Federal threatened	2	2	1	1	1	1
# State endangered	3	3	2	2	2	2
# State threatened	0	0	0	0	0	0
Area of alignment within sensitive habitat (per CNDDB)	526,911	526,911	383,674	383,674	383,674	383,674

OBJECTIVE	Alignments					
	U.S. 101 (Exclusive Guideway)		Caltrain (Exclusive Guideway)		Caltrain (Shared Use)	
	Transbay Terminal Station	4th & King Terminal Station	Transbay Terminal Station	4th & King Terminal Station	Basic Service Option w/Grade Separations	Four-track Station Option
ENVIRONMENTAL JUSTICE IMPACTS (Demographics)	4	4	4	4	4	4
# block groups >50 percent Minority	66	66	56	56	56	56
# block groups >50 percent low-income	1	1	1	1	1	1
Potentially affected minority population	20,735	20,735	18,716	18,716	18,716	18,716
Potentially affected low-income population	2	2	2	2	2	2
FARMLAND IMPACTS	No farmland impacts					
CULTURAL RESOURCES IMPACTS	5		1		5	4
# of known resources within ROW	• 3 historic resources		• Adverse effects on 6 historic train stations: Santa Clara, Palo Alto, Menlo Park, San Carlos, Burlingame, & Millbrae.		• No effects on 6 historic train stations	• Possible adverse effects on Santa Clara, Menlo Park, & Burlingame historic stations from single-track bypass structures – depending on design & location of bypass
PARKS & RECREATION/ WILDLIFE REFUGE IMPACTS	3		4			
	• Passes through or adjacent to 12 parks • Need to evaluate avoidance & mitigation alternatives		• Passes through El Palo Alto Park • Need to evaluate avoidance & mitigation alternatives			
SOILS/SLOPE CONSTRAINTS	5	5	4	4	4	4
Area of highly erodible soils (square meters)	595,835	595,835	955,283	955,283	955,283	955,283
Area of high shrink/ swell soils (square meters)	830,006	830,006	989,454	989,454	989,454	989,454
Area of steep slopes - greater the 9 percent (square meters)	0%	0%	0%	0%	0%	0%

OBJECTIVE	Alignments					
	U.S. 101 (Exclusive Guideway)		Caltrain (Exclusive Guideway)		Caltrain (Shared Use)	
	Transbay Terminal Station	4th & King Terminal Station	Transbay Terminal Station	4th & King Terminal Station	Basic Service Option w/Grade Separations	Four-track Station Option
SEISMIC CONSTRAINTS	• San Bruno Fault • All high-speed train facilities would be designed taking into account existing soil, groundwater, and geologic conditions in the area and to withstand maximum credible earthquakes from fault activity in the area.					

1 2 3 4 5

Least Favorable **Most Favorable**

Table 4.2-2
Bay Area-to-Merced Corridor --- High-Speed Train Station Evaluation Matrix
San Jose-to-San Francisco Segment

Evaluation Criteria	Station					
	Santa Clara (Optional)	**Redwood City**	**Palo Alto**	**San Francisco Airport**	**Fourth / King**	**Transbay Terminal**
	U.S. 101 & Caltrain Separate Use & Caltrain Shared Use	**U.S. 101 Caltrain Separate Use Caltrain Shared Use**	**Caltrain Separate Use Caltrain Shared Use**	**U.S. 101 Caltrain Separate Use Caltrain Shared Use**	**U.S. 101 & Caltrain Separate Use Caltrain Shared Use**	**U.S. 101 & Caltrain Separate Use Caltrain Shared Use**
Maximize Ridership/Revenue Potential.						
POPULATION/EMPLOY-MENT CATCHMENT (YEAR 2020)	4 • 982,532 employment • 845,419 population • Assumes a station at San Jose (Diridon)	2 • 363,620 employment • 196,560 population	2 • 363,620 employment • 196,560 population	3 • 446,180 employment • 255,272 population	5 • 1,649,168 employment • 1,130,289 population • Assumes a station in Oakland	5 • 1,649,168 employment • 1,130,289 population
Maximize Connectivity and Accessibility.						
INTERMODAL CONNECTIONS	5 • Caltrain • ACE • Capital Corridor • VTA buses • Possible connector to San Jose Airport	2 3 3 • VTA buses • 101 Freeway • Caltrain • Caltrain • VTA buses	3 • Caltrain • Samtrans buses	3 5 5 • Samtrans busses • Airport shuttles • 101 Freeway • Caltrain • Caltrain • Samtrans buses • BART to SFO & San Francisco • 101 Freeway	4 • Caltrain • MUNI Metro • MUNI buses • 280 Freeway	5 • AC Transit buses • Greyhound • Para-transit • MUNI buses • Caltrain
Minimize Operating and Capital Costs						
OPERATIONAL ISSUES	4 • See entry below	5 4 U.S. 101 • No operation issues identified	4 • See below	5 4 U.S. 101 • Coordination with SFO services/ access	4 • Coordination with Caltrain Yard & station operations & program	4 • Coordination with Transbay Terminal operations & program
	Caltrain Corridor Options • Coordination with Caltrain regarding station operations, use of common & separate facilities, passenger flows, & other physical and operating relationships.					

Evaluation Criteria	Station					
	Santa Clara (Optional)	**Redwood City**	**Palo Alto**	**San Francisco Airport**	**Fourth / King**	**Transbay Terminal**
	U.S. 101 & Caltrain Separate Use & Caltrain Shared Use	**U.S. 101 / Caltrain Separate Use / Caltrain Shared Use**	**Caltrain Separate Use / Caltrain Shared Use**	**U.S. 101 / Caltrain Separate Use / Caltrain Shared Use**	**U.S. 101 & Caltrain Separate Use / Caltrain Shared Use**	**U.S. 101 & Caltrain Separate Use / Caltrain Shared Use**
CONSTRUCTION ISSUES	3	5 3 5	3 5	5 3 5	3	1 5
	• Construction must occur over active railroad. • Staged construction & shooflys may be required.	U.S. 101 • Minimal construction impacts at stations	(see below)	U.S. 101 • Minimal construction impacts at stations	U.S. 101 & Caltrain separate use • Construction must occur over active railroad. • Staged construction & shooflys may be required.	• Difficult construction in bay mud • Coordination with Transbay Terminal operations & program
		Caltrain separate use • Construction must occur over active railroad. • Staged construction & shooflys may be required.				
	• Minimal impact under Shared Use options					
CAPITAL COST	• Urban station costs				• Urban station costs • Aerial station over active train yard	• Assume ½ cost of San Francisco Caltrain Downtown Extension
RIGHT-OF-WAY ISSUES/COST	5	3 5 5	5 5	3 5 5	3 3 5	5
	• No ROW assumed; station on Caltrain ROW	U.S. 101 • Acquire current amusement park.	(see below)	U.S. 101 • Acquire industrial property.	U.S. 101 and Caltrain Separate Use • Aerial easement needed	• No ROW assumed
		Caltrain separate use • No ROW assumed. • Station on Caltrain ROW				
		Caltrain Shared Use • No separate station				

Evaluation Criteria	Station					
	Santa Clara (Optional)	**Redwood City**	**Palo Alto**	**San Francisco Airport**	**Fourth / King**	**Transbay Terminal**
	U.S. 101 & Caltrain Separate Use & Caltrain Shared Use	**U.S. 101** **Caltrain Separate Use** **Caltrain Shared Use**	**Caltrain Separate Use** **Caltrain Shared Use**	**U.S. 101** **Caltrain Separate Use** **Caltrain Shared Use**	**U.S. 101 & Caltrain Separate Use** **Caltrain Shared Use**	**U.S. 101 & Caltrain Separate Use** **Caltrain Shared Use**
Maximize Compatibility with Existing and Planned Development.						
LAND USE COMPATIBILITY AND CONFLICTS	4	5 3 4	3 4	5 3 4	4 4	5
	• Generally compatible with commercial/ industrial area • Must be sensitive to historic station	U.S. 101 • Station on commercial or undeveloped land • Better ability to accommodate parking structure compared to Caltrain corridor stations • Better vehicular traffic access than Caltrain corridor stations	(see below)	U.S. 101 • Station on commercial or undeveloped land • Better ability to accommodate parking structure compared to Caltrain corridor stations • Better vehicular traffic access than Caltrain corridor stations	U.S. 101 & Separate Use • Large station structure over existing Caltrain yard & station – generally compatible	• Fully compatible & complementary
		Caltrain Separate Use • Introduce major structure over Caltrain ROW in town center – potential for critical visual/shade/shadow impacts and land use barrier.			• Fully compatible & complementary	
		Caltrain Shared Use • For Shared Use, generally compatible with commercial in suburban town centers – grade separations in town centers could be disruptive to land use & street system				
VISUAL QUALITY IMPACTS	4	4 1	1	4 1	4	5
	5	5	5	5		
	• Commercial/ industrial area but design must be sensitive to historic station	U.S. 101 • Minimal Impacts		U.S. 101 • Minimal Impacts	• Minimal impact given industrial/ commercial location, although residential being developed in Mission Bay area.	• No impacts assumed.
		Separate Use • Station box over rail line • Impacts to suburban town center	Separate Use • Station box over rail line • Design must be sensitive to historic station • Impacts to suburban town center	• Separate Use • Station box over rail line • Design must be sensitive to historic station		
		Shared Use No impacts				

Evaluation Criteria	Station					
	Santa Clara (Optional)	**Redwood City**	**Palo Alto**	**San Francisco Airport**	**Fourth / King**	**Transbay Terminal**
	U.S. 101 & Caltrain Separate Use & Caltrain Shared Use	**U.S. 101 Caltrain Separate Use Caltrain Shared Use**	**Caltrain Separate Use Caltrain Shared Use**	**U.S. 101 Caltrain Separate Use Caltrain Shared Use**	**U.S. 101 & Caltrain Separate Use Caltrain Shared Use**	**U.S. 101 & Caltrain Separate Use Caltrain Shared Use**
Minimize Impacts to Natural Resources.						
WATER RESOURCES	• No impacts from stations anticipated for water resources					
FLOODPLAIN IMPACTS	5	5	1	1	5	5
	• Not in floodplain	• Located in 100-year floodplain • Not in floodplain	• Located in 100-year floodplain • Not in floodplain	• Both stations located in 100-year floodplain	• Neither station located in floodplain	• Neither station located in floodplain
THREATENED & ENDANGERED SPECIES IMPACTS	5			3	5	
	• No impacts identified on statewide database			• Potential impacts to California Clapper Rail	• No impacts identified on statewide database	
Minimize Impacts to Social and Economic Resources.						
ENVIIRONMENTAL JUSTICE IMPACTS (Demographics)	5	4		5		
	• No disproportion impacts anticipated	• Minority populations in station area • No disproportion impacts anticipated		• No disproportion impacts anticipated		
FARMLAND IMPACTS	No stations located in farmlands					
Minimize Impacts to Cultural Resources.						
CULTRUAL RESOURCE IMPACTS	3	5			5	5
		5	3	3		
	• Historic Train Station • Mitigation and/or sensitive design required	• No known cultural resources			• No known cultural resources	• Existing Historic Terminal • No impacts anticipated at new terminal
		• No known cultural resources	• Historic Train station • Mitigation and/or sensitive design required	• Historic Train station • Mitigation and/or sensitive design required		
PARKS & RECREATION / WILDLIFE REFUGE IMPACTS	• No station located in public recreation or wildlife refuge areas					

1 2 3 4 5

Least Favorable **Most Favorable**

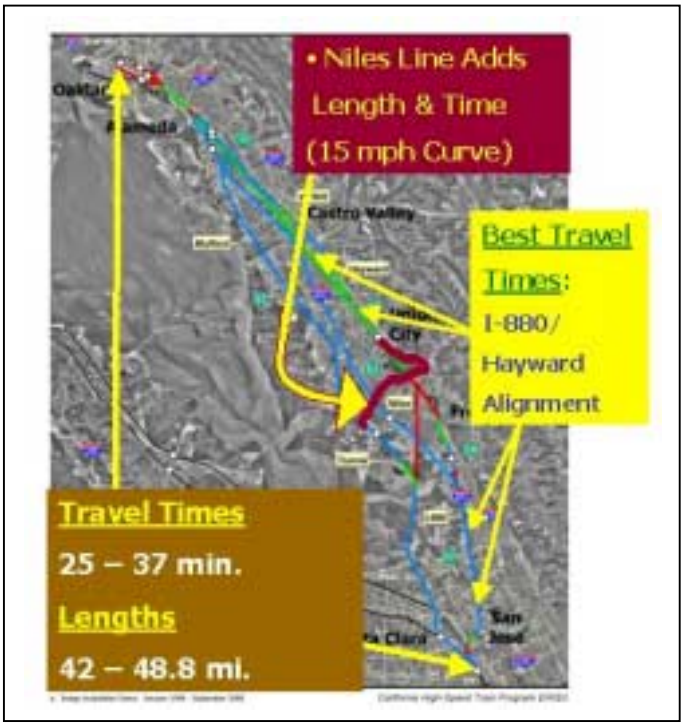
4.3 San Jose-to-Oakland Segment

The following sections compare various characteristics of the alignments and stations within the San Jose-to-San Francisco Segment. Summary statistics and characteristics are shown at the end of this section in Table 4.2-1 for the alignments and in Table 4.2-2 for the stations.

4.3.1 Maximize Ridership/Revenue Potential

A. TRAVEL TIME

Alignment Evaluation/Comparison*:*
The travel times for this segment vary from 25 to 37 minutes, a significant increase of almost 50 percent. The longest travel times are for those subsegments utilizing the existing Niles Junction area tracks. Existing speed is limited to 15 mph in this area, and it is assumed that this could be increased to 30 mph for high-speed trains.



The fastest travel time is for the I-880/Hayward subsegment, which utilizes a new alignment from Diridon Station into the I-880 median, which is fairly wide and straight in this section. The speed-restrictive section for this subsegment is in the Warm Springs through Fremont area, which involves tight ROW and deep tunneling. Future design should improve these speed restrictions.

Speed on the Mulford line is limited to the existing alignment, which is generally 79 mph for the freights, and it appears that high-speed train could perform at 90 to 150 mph. For the I-880 Alignment, the older section of I-880 has some restrictive curves, and train speed would be limited to 80 mph to match the highway geometry. The WPRR alignment is limited by having to follow the railroad, including as it passes below BART several times limiting a continuous high speed.

B. LENGTH

Alignment Evaluation/Comparison: The shortest alignment is also the fastest – I-880/Hayward Alignment – with a length of 41.8 miles. The longest alignment is also the slowest – the Mulford/Niles/WPRR Alignment – with a length of 48.8 miles, an increase of about 15 percent.

The I-880/Hayward Alignment is generally straight along I-880 and the Hayward branch, with no speed restrictions due to the geometry along the Hayward branch. The Mulford/Niles/WPRR Alignment has some significant right-angle turns along the Niles junction area, resulting in increased length and reduced speed. The WPRR Alignment curves further to the east and adds some restrictive curves along the line, adding to the overall length.

C. POPULATION/EMPLOYMENT CATCHMENT

Station Evaluation/Comparison: Population and employment catchment levels for the South Alameda County stations are deemed to be generally equal, but significant, given their location near the employment areas of Silicon Valley. The coliseum catchment is lower, but would provide for a direct connection to the Oakland Airport (via the proposed Oakland Airport Connector), and would serve the special functions at the Coliseum, as well as providing a direct connection to the BART station. The population catchment for the Oakland stations is deemed equal and very significant.

4.3.2 Maximize Connectivity and Accessibility

A. INTERMODAL CONNECTIONS

Station Evaluation/Comparison: The station for the Mulford Alignment at **Auto Mall Parkway** would interconnect with the Capitol Corridor, ACE, and the AMTRAK Starlight service. It is anticipated that additional bus service would also serve this station. The **I-880 Mowry Avenue** Station would provide good highway connection but no other train service connections. The **Warm Springs Station** would provide direct access to the BART Fremont line and local bus service. Commuter rail would not be served. The **Union City** intermodal terminal would provide access to the BART Fremont line, Capitol Corridor trains, and possible shortened ACE service to San Jose. A possible future Dumbarton service to the Peninsula could also be served from this station. The **Oakland Airport/Coliseum Station** would provide direct connection to Capitol Corridor trains, the BART Fremont and Dublin lines, and the proposed connector to the Oakland Airport. Oakland terminals stations would connect to either various BART lines **(Lake Merritt, 12th/City Center, West Oakland)** or to the Capitol Corridor trains and the AMTRAK Starlight service at **Jack London Square**. The Oakland terminal stations should be evaluated in conjunction with the Coliseum Station to provide complementary interconnectivity.

4.3.3 Minimize Operating and Capital Costs

A. LENGTH

Alignment Evaluation/Comparison: There is a 20 percent difference between the highest and lowest cost alignment. The two lowest cost alignments are the I-880/Hayward and the Mulford/Niles/Hayward subsegments, which are almost identical in capital cost. The highest cost alignments are the Mulford/Tunnel alignments for both Hayward and the WPRR. Operating costs are directly related to travel times and length, in addition to complexity of the alignment and structures involved. At-grade alignments are easier to maintain than are aerial structures and belowground sections. Severe curves, such as those required for the Niles Junction connection, would require more maintenance than straight sections. The I-880/Hayward subsegment has the highest amount of at-grade tracks, the straightest alignment, the shortest length, and the shortest travel time, and therefore should have the lowest operating cost for all the subsegments.

B. OPERATIONAL ISSUES

Alignment Evaluation/Comparison: Operational issues include areas of noise and environmental sensitivity, speed restrictions, station location, and terminal operation.

The Mulford segment is on continuous aerial structure in a restrictive ROW passing through residential, commercial areas, and the San Francisco Wildlife Refuge. Through the residential areas, the line also has some limiting curves, resulting in lower speed due both to geometry and noise limitations through residential neighborhoods. High-speed train may be limited through the Wildlife Preserve to minimize impacts on wildlife or other design or mitigation measures may be incorporated into the project.

The I-880 alignment would be in the median of the highway and consequently would need to follow the highway geometry fairly closely. This would limit train speeds in the older sections of highway with restrictive curves.

The Hayward alignment would follow the existing railroad corridor where the Capitol Corridor trains presently operate at 79 mph. The high-speed train project would include grade separation of all remaining grade crossings to eliminate grade crossing hazards and noise and allow for higher speeds for all modes. There are two industrial sidings that cross to the east that would have to be eliminated or high-speed tracks would need to be grade separated from these sidings. The potential exists for this alignment to share tracks and/or station sites with commuter rail, i.e., the Capitol Corridor service.

The WPPR Alignment would require that the high-speed train alignment pass below the BART structure twice, resulting in speed restriction as the train transitions from one side of BART to the other, along with the elevation changes.

Station Evaluation/Comparison:

South Alameda Stations:

The South Alameda County Stations would operate in a similar fashion, with pedestrian access and passageways to adjacent transit providers (BART, Capital Corridor, ACE) for all but the Mowry Avenue Station on the I-880 Alignment

Airport Coliseum Stations:

The Airport/Coliseum stations would all operate in a similar fashion, with pedestrian access and passageways to BART (WPRR) or the Capital Corridor (Mulford & Hayward) and to the proposed Oakland Airport Connector People Mover for all station options. For the Mulford and Hayward alignments, the area is presently industrial and is planned to be redeveloped into a major transit oriented development. The current concept is for high-speed train development over the station site. Operationally, the potential exists to share the station and platforms with the Capitol Corridor service, reducing costs and facilitating passenger transfers. The Coliseum/Airport/BART Station on the WPRR Alignment would be directly adjacent to the east of the BART alignment in an aerial configuration, with a mezzanine below, allowing for a direct transfer to BART. The area to the east is presently parking, residential, and commercial. It is being planned to become part of the transit-oriented development. The station would not encroach on this development, but would be restricted to the acquired railroad property to the east of BART. The anticipated future airport connector would also be accessible from this location.

Oakland Terminal Stations:

Three of the four Oakland terminal stations would have access to and passageways to BART Stations – the West Oakland, Lake Merritt, and City Center Stations. The Jack London

Square Terminal Station would be under the Embarcadero in a mined tunnel configuration. The station would provide for direct transfer to the AMTRAK Station but not to BART.

C. CONSTRUCTION ISSUES

Alignment Evaluation/Comparison:

The Mulford Alignment is aerial structure and would require the construction of footings adjacent to an active railroad and under adjacent residential and commercial property to the east. These properties would need to be acquired. There is sufficient clearance to the freight tracks not to require track closures. Erection of aerial structure beams would require either a top down construction method or track closures.

The I-880 Alignment is similar to the Mulford alignment in an aerial configuration requiring the construction of footings within the highway ROW and would require lane closures adjacent to the column on both sides. This likely would result in off-peak construction. The erection of aerial structure beams again would result in lane closures. As the highway becomes narrower and requires full median widening, construction issues would be similar to major highway reconstruction – demolition of existing adjacent property, new noise walls, demolition of exist noise walls, constructing new highway lanes, and maintenance of traffic.

The Hayward Alignment would begin in I-880 and present similar construction issues of constructing columns and footings in a wide median. The section along the Warm Springs station would require construction between two active rail lines – BART and the UPRR. The tunnel under the park in Fremont would represent major construction issues due to the high water table and the presence of gravels. The rail corridor from Union City to Oakland is 100 feet wide and would require that the line be completely grade separated and that the existing railroad tracks be permanently relocated to the western side of the ROW. This would leave sufficient space for high-speed tracks to be constructed in an at-grade ROW.

The WPRR Alignment would have as major construction issues including the rearrangement of the BART foundations to allow for the high speed alignment to pass from one side of BART to the other, which is required twice due to the ROW restraints. There is also a short cut-and-cover section required under San Leandro Boulevard in Oakland.

The Niles connector would follow the existing UPRR tracks, which would have to be grade separated for high-speed trains. This would result in a 100 foot-wide trench requiring complicated maintenance of traffic solutions for freight and commuter traffic.

The Fremont tunnel would need to be constructed in similar geotechnical conditions as the tunnel under Fremont Central Park, except that this tunnel would be significantly longer and under proposed commercial development. Once the development is in place, this would become significantly more difficult.

The Jack London Square Terminal Station segment has a short section of at-grade adjacent to the UPRR, which would require reconstruction of the railroad tracks. The major construction issue would be the bored tunnels in the bay mud underneath the Embarcadero and the active UPRR tracks. The ROW is approximately 80 feet for a short section.

The West Oakland Terminal Station segment would require the continuation of the bored tunnels described above to West Oakland, where the line would be constructed by cut-and-cover techniques. Passing below I-880 will possibly require the reconstruction of several footings and support columns for I-880. The cut-and-cover section in the median of Mandela Parkway would

be in a residential neighborhood, requiring appropriate construction techniques to minimize noise, dust, and traffic maintenance.

The Lake Merritt Terminal Station segment would require the construction of a tunnel or subway through the campus of Laney College adjacent to the BART alignment. The tailtracks would be constructed by bored tunnel under 7th Street

The City Center Terminal Station segment would require the construction of a cut-and-cover subway beneath East 12th Street, requiring utility relocation, support of existing BART facilities, and major maintenance of traffic issues. The section from Lake Merritt to Broadway is proposed as bored tunnel due to the deep nature of the tunnel. Construction techniques would need to address the narrow 80-foot ROW and access to the tunnel. A deep cut-and-cover excavation (90 feet deep) is proposed for the station, involving very difficult and costly construction. Such construction may be cost-prohibitive.

Station Evaluation/Comparison:

The Mulford station at the **Auto Mall Parkway** presents no major construction issues. The station is at-grade with a concourse above. There is an active railroad to the west and proper clearances need to be maintained.

The I-880 station at **Mowry Avenue** in Newark would present difficult construction issues over an active highway. Bent structures would be required over one side of the highway to support the concourse level and would require highway closures during their erection.

The **Warm Springs Station** would require the relocation of BART to the east and the construction of the high-speed train station and facilities between two active railroads – BART and the UPRR. Relocating BART under operating conditions would be a very difficult task both technically and operationally

Union City is could provide an area for a future high-speed train station and tracks directly adjacent to the BART line and station. Construction would be fairly straightforward.

The **Coliseum/Airport/BART Station on the WPRR Alignment** is in a 100-foot wide ROW adjacent to the BART station and an access roadway to the parking facility. Care will need to be taken while constructing an aerial structure directly adjacent to the BART lines.

The **Coliseum/Airport/BART Station on the Mulford and Hayward alignments** would require the reconstruction of the Capitol Corridor platforms and, depending on timing, could require construction of the station in the lower level of the new planned development, or the new development would need to be constructed over the high-speed train facilities. With proper coordination and timing the construction issues are fairly common.

The **Coliseum/Airport Station on the I-880 Alignment** would be off to the side of I-880, requiring major bent structures to cross the northbound lanes of I-880. Once on the side of the highway, the construction issues are fairly common.

The **Jack London Square Terminal Station** would need to be constructed adjacent to and above the bored tunnels beneath the active rail corridor. Relocating the railroad even temporarily is probably not an option. A cut-and-cover access would need to be constructed within the AMTRAK parking lot and a mined concourse excavated over the bored tunnels. This is extremely difficult construction and could be cost prohibitive.

The **West Oakland Terminal Station** would be constructed by cut-and-cover techniques within the median of Mandela Parkway and some ROW presently occupied by parking. Maintenance of traffic along 7th Street and Mandela Parkway will be an issue. Utility relocation in the cross streets will be a fairly common construction issue.

The **Lake Merritt Terminal Station** would be constructed by cut-and-cover techniques within the ROW of 7th Street. Utility relocation will be a construction issue along with the maintenance of traffic along 7th street and the cross streets. A concourse would be constructed along Oak Street to connect to the BART concourse using cut-and-cover techniques.

The **City Center Terminal Station** would be constructed adjacent and perpendicular to the existing BART station by cut-and-cover techniques. The platform level for high-speed trains would be one level deeper than the BART platform level, which was constructed in a similar manner. This excavation would be the deepest of all of the terminal station options. The extra levels required to be excavated would be used for parking connecting to the existing underground parking structure. Passing under BART will be major construction issue and will require mining techniques for this short section – approximately 60 feet. Utility relocation will be a construction issue along with the maintenance of traffic along 12th Street and the other cross streets.

D. CAPITAL COST

Alignment Evaluation/Comparison: The alignment combinations with the most at-grade sections have the lowest cost, i.e. alignments that incorporate the Hayward and WPRR corridors. These include the Mulford/Niles/Hayward, the Mulford/Niles/WPRR, the I-880/Hayward and the I-880/WPRR alignments. The alignment combinations with the most tunnel and aerial structure have the highest cost, i.e., alignments that incorporate the Fremont tunnel, all of I-880, and all of the Mulford line. These include the Mulford/Tunnel/Hayward Alignment and the Mulford/Tunnel/ WPRR, at about $500 million more than the least expensive alignment; and the I-880 (Entire Segment), and the Mulford line (Entire Segment) at about $250 million more than the least expensive alignment.

Station Evaluation/Comparison: For the South Alameda stations, the Warm Springs and the I-880 stations would have the highest cost, with the Auto Mall parkway and Union City stations having the lowest. The Coliseum stations would be similar in cost to the Auto Mall Parkway and Union City stations.

For the Oakland terminal stations, Lake Merritt is estimated to be the lowest cost with the City Center being approximately six percent higher and the West Oakland Station about 10 percent higher. The Jack London Square would have the highest cost, some 35 percent higher than the estimate for the Lake Merritt Station. The Jack London Square Station also exhibits the greatest construction risks.

E. RIGHT-OF-WAY ISSUES/COST

Alignment Evaluation/Comparison: The lowest ROW costs are for the alignment combinations that utilize the Hayward line and the WPRR alignments. ROW cost estimates for the Mulford line are generally three times higher and the I-880 Alignment (Entire Segment) is estimated to be four times higher.

The Mulford line would require a portion of the UPRR corridor (that is generally 60 feet wide) for aerial structure foundations and for an aerial easement over the tracks. In addition the residential, commercial, and light industrial areas to the east of the alignment would need to be

acquired. The I-880 (Entire Segment) Alignment would require significant ROW in the more northern area to be able to expand the highway sufficiently to allow for high-speed train tracks in the median. For the Hayward and WPRR alignments, ROW would be required along the BART/UPRR corridor near Warm Springs and an underground easement below Fremont Central Park for a tunnel alignment. For the Hayward and the WPRR segments, the UPRR would need to agree to sell a portion of the Hayward line and the entire WPRR segment.

Station Evaluation/Comparison:

South Alameda Stations:

The **Auto Mall Parkway Station for the Mulford** line would have minimal ROW impact on developed land and is adjacent to a planned commuter rail station. The **I-880 station near Mowry Avenue** would require significant ROW on the west side near the Newpark Mall commercial area A **Warm Springs Station** would require ROW currently planned for the BART Warm Springs Station and would require the relocation of the BART facilities shortly after they are built. **Union City** has identified possible ROW for future high-speed train facilities at its multi-modal station.

Coliseum Stations:

The **Coliseum/Airport/BART Station on the Mulford and Hayward alignments** would require ROW from the planned BART transit oriented development, providing for possible joint development of this area. The **Coliseum Station on the I-880 corridor** would require ROW from the Freeway and from the Oakland Coliseum. The **Coliseum/Airport/BART Station for the WPRR** could be developed within the existing railroad ROW.

Terminal Stations:

The **Jack London Square Terminal Station** would require ROW from AMTRAK within their parking area as well as subsurface easements from the UPRR. The **West Oakland Terminal Station** would be situated mostly in public street ROW, with minimal private commercial property required. The **Lake Merritt Terminal Station** would require subsurface easements from Laney College for the subway section. The remainder of the station would be in street ROW. The **City Center Terminal Station** would require minimal ROW for the tunnel and access to the terminal

4.3.4 Maximize Compatibility with Existing and Planned Development

A. LAND USE COMPATIBILITY AND CONFLICTS

Alignment Evaluation/Comparison: In general the San Jose to Oakland segments follow existing transportation corridors except for the short segments as the alignments transition from one corridor to another. These transitions would occur under Fremont Central Park and under Fremont for the tunnel. The Central Park alignment is proposed as a deep tunnel under the Park. The Fremont tunnel would be under proposed commercial development.

Potential conflicts would occur with use of the Mulford line, which is in a narrow ROW. Existing rail providers have expressed interest in expanding their own services.

Station Evaluation/Comparison: All the proposed stations and terminals would be adjacent to existing or planned transportation facilities and would generally represent compatible land uses. Conflicts would arise with the Warm Springs Station, given the need to relocated the planned BART station, and to a lesser degree at the Coliseum station, with the planned transit oriented development. With proper advance planning, potential conflicts at the Coliseum/Airport/BART Station could be mitigated.

B. VISUAL QUALITY IMPACTS

Alignment Evaluation/Comparison*:* The greatest visual impact would be for the aerial alignments in a narrow corridor. The Mulford line is generally a 60-foot wide corridor with some 100-foot and some 50-foot sections. An aerial structure in the 60-foot corridor would be directly adjacent to the residential and commercial properties and would be visually intrusive for these properties.

The I-880 aerial structure, although similar in design, would be less intrusive, given that it would be in the median of a wide highway. As it passes over the existing cross roadways, the structure would be more visually intrusive as it nears 40 feet in height, although it would still be in the median of an eight-lane highway, and from the cross roadway, would appear as a normal height structure.

The proposed alignment along the Hayward branch would be at-grade and follow the existing freight and commuter railroad. It would be closer to adjoining properties than the existing track by approximately 35 feet but visually compatible with the existing rail use. The high-speed train facilities for the WPRR alignment would be similar to the BART structure adjacent to it, thereby having minimizing the visual impact.

Station Evaluation/Comparison: The stations directly adjacent to other transportation facilities in a similar configuration would have limited visual impact. These include the Auto Mall Parkway, Warm Springs, Union City, and Coliseum/Airport/BART stations. Visual impacts for the subsurface Oakland terminal stations would only be at the surface access points, e.g., the vertical circulation facilities identifying the terminal station, and any parking or other ancillary facilities.

The station with high visual impact would be the I-880 station near Mowry Avenue. This would be an aerial station over the highway. The I-880 Coliseum/Airport Station would have a similar high impact, although the bents across the highway would be predominant. The aerial station along the WPRR alignment would be similar in visual impact to the existing BART station except that it would be 100 feet closer to the proposed new transit oriented development than the BART station.

4.3.5 Minimize Impacts to Natural Resources

A. WATER RESOURCES

Alignment Evaluation/Comparison: The Mulford alignments would have the highest number of water resource crossings (39-40), including the sensitive Don Edwards San Francisco Bay National Wildlife Refuge Area. This number is reduced for the Mulford Tunnel alignments, with 31-32 crossing, but these still include the Wildlife Refuge crossing. Alignments using the I-880, either for its entire length or in combination with the Hayward or WPRR rail lines, would have the fewest crossing, ranging from 21 to 23. The Hayward and WPRR alignments would tunnel under the Fremont Central Park Lake.

Station Evaluation/Comparison: None of the stations in the San Jose-to-Oakland Segment are expected to have critical impacts on any water resources.

B. FLOODPLAIN IMPACTS

Alignment Evaluation/Comparison: The Mulford alignments include the greatest length within the 100-year floodplain, with nearly 17,000 meters for the Mulford (Entire Segment) Alignment, and over 12,000 meters for the Milford/Niles/Hayward and Mulford/Niles/WPRR Alignments.

A portion of this flood area is the approximate four miles of line in the Don Edwards San Francisco Bay National Wildlife Refuge Area. The I-880 (Entire Segment) also has significant length of alignment in the 100-year flood area, with over 13,000 meters, but the portions of all alignments using the I-880 Freeway would be completely aerial, above the floodplain area. The least amount of floodplain impact would be for the alignments with tunnel segments.

Station Evaluation/Comparison:

The Auto Mall Parkway Station on the Mulford Alignment would be located in the 100-year floodplain. Station platforms and tracks would be designed at an elevation above 100-year flood levels. To the extent possible, station access and ancillary facilities, would be designed at an elevation above 100-year flood levels or to withstand flooding.

C. THREATENED & ENDANGERED SPECIES IMPACTS

Alignment Evaluation/Comparison: According to the statewide GIS database, for the San Jose-to-Oakland alignments, the I-880/WPRR Alignment would have the highest amount of alignment passing through sensitive habitat – 464.067 meters. A portion of this alignment would be on aerial structure in the center of the I-880 Freeway, however. In fact, the I-880 Freeway (Entire Segment) Alignment would pass through 221,455 meters of sensitive habitat, with the alignment in the median of a busy freeway. Minimal impacts would be anticipated to wildlife for these freeway portions of the alignments using the I-880 median.

The Mulford alignments would cross multiple marshlands, seasonal wetland, rivers, plus approximately four miles of the Don Edwards San Francisco Bay National Wildlife Refuge – a major wildlife and bird sanctuary. The Mulford alignments would have the second highest length of alignment passing through sensitive habitat – with 382,631 meters crossed by the Mulford (Entire Segment), 320,615 meters crossed by the Mulford/Niles/Hayward Alignment, and 313,301 meters crossed by the Mulford/Niles/WPRR Alignment.

The Mulford alignments with tunnel segments would have fewer meters of alignment in sensitive habitat, with 262,483 meters crossed by the Mulford/Tunnel/Hayward Alignment and 271,282 meters crossed by the Mulford/ Tunnel/WPRR Alignment.

Examples of the species that could be affected by the alignments are the salt-marsh harvest mouse, vernal pool tadpole shrimp, and the Contra Costa Goldfields.

Station Evaluation/Comparison: Based on information contained in the statewide GIS database, no threatened or endangered species were identified for the station areas in the San Jose-to-Oakland Segment.

4.3.6 Minimize Impacts to Social and Economic Resources

A. ENVIRONMENTAL JUSTICE IMPACTS (DEMOGRAPHICS)

Alignment Evaluation/Comparison: According to the statewide database information, minority populations reside along the Mulford line in Santa Clara County, along all alignments in central Alameda County, and in the southern, western, and central portions of Oakland. With the distribution of minority populations along all alignments, disproportionate impacts to these populations are not anticipated among the myriad alignments. Moreover, provision of high-speed train service would offer beneficial affects for all populations within the Bay Area-to-Merced corridor.

Station Evaluation/Comparison: All of the stations in Oakland (West Oakland, Jack London Square, City Center, Lake Merritt, Airport/Coliseum/BART are in areas with minority populations greater than 50 percent. However, given the station locations, minimal impacts would be expected for these populations, and provision of high-speed train service would offer beneficial effects for all populations within the Bay Area-to-Merced corridor.

The most adverse impacts from the Oakland stations located in minority areas likely would be during the construction period for the Lake Merritt and West Oakland stations. Residential uses appear to be more proximate to these potential station sites, as compared to the Jack London Square and City Center site, which are more commercial in nature.

C. FARMLAND IMPACTS

Alignment Evaluation/Comparison: As indicated by the statewide GIS data, the Mulford Alignments would potentially have the greatest effect on farmlands, with 3,968 meters of alignment passing through farmlands of statewide importance, and over 38,000 meters of unique farmland. These impacts occur even for the Mulford alignments with tunnel segments. Alignments using the I-880 corridor would have no effect on farmlands.

Station Evaluation/Comparison: The Warm Springs Station is the only station among the San Jose-to-Oakland stations with potential impacts to farmlands.

4.3.7 Minimize Impacts to Cultural Resources

A. CULTURAL RESOURCES IMPACTS

Alignment Evaluation/Comparison: An affirmative survey was not performed for cultural resources. However, based on available information, the Mulford alignments would pass over the historic railroad north of Santa Clara Station (Centerville to Santa Clara) and through the historic communities of Alviso and Drawbridge. The Mulford/Niles alignments would also pass through the historic area of Niles.

Station Evaluation/Comparison: None of the stations in the San Jose-to-Oakland Segment appear to be in areas with critical cultural resources.

4

B. PARKS & RECREATION/WILDLIFE REFUGE IMPACTS

Alignment Evaluation/Comparison: The most critical park and wildlife refuge area through which the San Jose-to-Oakland alignments would pass appears to be the Don Edward's San Francisco Bay National Wildlife Refuge. All of the Mulford alignments would pass through approximately

four miles of this natural wildlife refuge area. The Mulford alignments would also pass near or through the following park and recreation/wildlife areas: Santa Clara Golf and Tennis club, Newark Sport field Park, Ardenwood Regional Preserve, Hayward regional Shoreline, San Lorenzo Park, and the Skywest Public Golf Course.

The I-880 corridor alignments would pass near or through the following park and recreation/ wildlife areas: Hamrick Park across the highway from Saint Rose Hospital, Eden Greenway, Washington Manor Park, Pacific recreation complex, Cherry Grove Park, and Grover Cleveland Park.

The I-880/Hayward Alignment would pass through or near the following park and wildlife areas: Fremont Central Park (over one mile in tunnel including directly under the lake), the quarry lakes, the C.F. Kennedy Park and Community Center, the HDCP Recreation Center and Park, Cannery Park (adjacent to the AMTRAK Hayward Station), and Thrasher Park.

The I-880/WPRR Alignment would pass through or near the Fremont Central Park (over one mile in tunnel including directly under the lake), the quarry lakes, C.F. Kennedy Park and Community Center, Siempe Verde Park, Stonehurst Park, and Coliseum Gardens Park.

Station Evaluation/Comparison: The Jack London Square and West Oakland terminal station alignments would pass through or near in an underground alignment Estuary Park, Lake Merritt, Channel Park (directly below requiring underground easement), and Chinese Park. The City Center Station Alignment would pass through or near in an underground alignment Clinton Square, East drive Peralta Park,

4.3.8 Maximize Avoidance of Areas with Geologic and Soils Constraints

A. SOILS/SLOPE CONSTRAINTS

Alignment Evaluation/Comparison:

The alignment routes from San Jose to Oakland follow existing transportation corridors and do not require major earthwork construction. Areas of soil constraints/concerns would be for the tunnel construction in Fremont and Oakland and the construction of the trench along the Niles connector. According to the statewide GIS database, all of the alignments are generally equivalent in terms of areas of high shrink/swell soils, with the Niles area showing slightly higher levels. The alignment with the least amount of highly erodible soils would be the Mulford line, with generally 40 percent fewer square meters. The other alignments would pass through over 1.2 million square meters.

B. SEISMIC CONSTRAINTS:

Alignment Evaluation/Comparison:

All Alignments in the San Jose-to-Oakland Segment would cross the Silver Creek Fault. The Hayward and WPRR Alignments would cross and run parallel to Hayward Fault, a major fault in the Bay Area.

- The Mulford line would cross the Silver Creek Fault three times.
- The I-880 line would cross the Silver Creek Fault once.
- The I-880/Hayward line would cross the Silver Creek Fault once, and the Hayward fault twice.
- The Mulford/Niles/Hayward line would cross the Silver Creek Fault once, and the Hayward fault twice.
- The I-880/WPRR line would cross the Silver Creek Fault once, and the Hayward fault three times. The line is adjacent to the Hayward fault for several miles in Hayward
- The Mulford/Niles/WPRR line would cross the Silver Creek Fault once, and the Hayward fault three times.
- The I-880/WPRR/Niles line would cross the Silver Creek Fault once, and the Hayward fault three times.
- The Mulford/Tunnel/Hayward would cross the Silver Creek Fault once and run directly adjacent to the Hayward Fault in the Fremont Central Park area.
- The Mulford/Tunnel/WPRR line would cross the Silver Creek Fault once and run directly adjacent to the Hayward Fault in the Fremont Central Park area. The line is adjacent to the Hayward fault for several miles in Hayward.

High-speed train facilities would be designed to account for anticipated maximum credible earthquakes from fault activity in the area.

Table 4.3-1
Bay Area-to-Merced Corridor -- High-Speed Train Alignment Evaluation Matrix
San Jose-to-Oakland Segment

Evaluation Criteria	Alignments							
	Mulford (Entire Segment)	Mulford/ Niles/ Hayward	Mulford/ Niles/ WPRR	Mulford/ Tunnel/ Hayward	Mulford/ Tunnel/ WPRR	I-880 (Entire Segment)	I-880/ Hayward	I-880/ WPRR
Maximize Ridership/Revenue Potential.								
TRAVEL TIME	3	2	1	4	3	3	5	4
	31 min.	34 min.	37 min.	27 min.	30 min.	32 min.	25 min.	28 min.
LENGTH	5	3	3	5	4	5	5	4
	42.3 miles (26.4 km)	46.2 miles (28.9 km)	48.8 miles (30.5 km)	42.2 miles (26.4 km)	44.8 miles (28.0 km)	42.0 miles (26.3 km)	41.8 miles (26.1 km)	44.4 miles (27.8 km)
Minimize Operating and Capital Costs.								
LENGTH	5	3	3	5	4	5	5	4
	42.3 miles (26.4 km)	46.2 miles (28.9 km)	48.8 miles (30.5 km)	42.2 miles (26.4 km)	44.8 miles (28.0 km)	42.0 miles (26.3 km)	41.8 miles (26.1 km)	44.4 miles (27.8 km)
OPERATIONAL ISSUES	2	2	1	3	3	3	4	4
	• Restrictive curves on aerial structure above residential areas. • Passes through Wildlife Refuge	• Passes through Wildlife Refuge. • Very restrictive curves on Niles connector. • 2 industrial freight sidings need to be eliminated	• Passes through Wildlife Refuge. • Very restrictive curves on the Niles connector & some speed restrictions on WPRR aerial segment	• Passes through Wildlife Refuge. • 2 industrial freight sidings need to be eliminated	• Passes through Wildlife Refuge	• Restrictive curves on I-880 north of Fremont	• 2 industrial freight sidings need to be eliminated	• Some speed restrictions on the WPRR aerial segment
CONSTRUCTION ISSUES	1	3	1	2	2	2	2	1
	• Construction of footings adjacent to railroad and to private ROW • Structure through Wildlife Refuge	• Potential for rated use. • Structure through Wildlife Refuge. • Trench section in Niles connector • Existing commuter rail service	• Structure through Wildlife Refuge. • Trench section in Niles connector. • Modifying BART Structure to allow for high-speed train s • Alignment changes from one side to other	• Structure through Wildlife Refuge • Tunnel construction through Fremont	• Structure through Wildlife Refuge • Tunnel construction through Fremont	• Constructing aerial structure in median of I-880. • Widening highway at northern end	• Constructin g aerial structure in median of I-880. • Tunnel beneath Fremont Central Park	• Construct- ing aerial structure in median of I-88 • Tunnel beneath Fremont Central Park • Modifying BART Structure
CAPITAL COST	2	5	4	1	1	2	5	4

Evaluation Criteria	Alignments							
	Mulford (Entire Segment)	Mulford / Niles / Hayward	Mulford / Niles / WPRR	Mulford / Tunnel / Hayward	Mulford / Tunnel / WPRR	I-880 (Entire Segment)	I-880 / Hayward	I-880 / WPRR
	• Approx. $250 million more.	• Least costly	• Least costly	• Approx. $500 more	• Approx. $500 more	• Approx. $250 million more.	• Least costly	• Least costly
RIGHT-OF-WAY ISSUES/COST	2	4	4	3	3	1	5	5
	• Approx. three times the lowest cost • Acquiring UPRR ROW & easement. • Acquiring 50-foot wide strip of private property	• Approx. twice the lowest cost • Acquiring UPRR ROW & easement. • Acquiring 2 freight sidings	• Approx. twice the lowest cost • Acquiring UPRR ROW & easement.	• Acquiring UPRR ROW & easement. • Acquiring 2 freight sidings	• Acquiring UPRR ROW & easement.	• Most costly • Acquiring strip of ROW for highway widening north of Fremont	• Least costly • Acquiring 2 freight sidings	• Least costly • Acquiring UPRR ROW
Maximize Compatibility with Existing and Planned Development.								
LAND USE COMPATIBILITY AND CONFLICTS	1	3		2		5		
	• Acquisition of 50-foot strip of private property • Within existing transportation corridor • Conflicts with expansion potential of existing rail service providers	• Within existing transportation corridor • Conflicts with expansion potential of existing rail service providers		• Conflicts with expansion potential of existing rail service providers • Requires subsurface easements for tunnel		• Within existing transportation corridor		
VISUAL QUALITY IMPACTS	1	3				4	4	
	• Visual impact to residential homes • Visual impact in Santa Clara business district & in historic Alviso					• Visual impact from high aerial structure in I-880 north of Fremont	• Visual impact from transition aerial structure near Mission Boulevard	
	• Visual impact from guideway over private property	(see above)						
Minimize Impacts to Natural Resources.								
WATER RESOURCES	1	1	1	3	3	5	5	5
# of crossing of alignment	40	40	39	32	31	23	22	21
FLOODPLAIN IMPACTS	1	3	3	5	5	2	4	4
# of 100 yr. floodplain crossings	18	18	19	17	15	22	22	23
Length of alignment within 100 yr. floodplain	16,963	12,717	12,605	8,571	8,100	13,286	9,592	9,480
Percent of total length within floodplain	26.9%	18.3%	18.1%	13.5%	12.8%	21.2%	15.3%	15.0%
THREATENED & ENDANGERED SPECIES IMPACTS	1	2	2	3	3	4	3	1
# of threatened & endangered species (per CNDDB)	**5**	**4**	**5**	**2**	**3**	**3**	**3**	**5**
# Federal Endangered	3	3	4	2	2	2	3	4
# Federal Threatened	2	1	1	0	1	1	0	1
# State Endangered	1	1	2	1	1	1	1	1
# State Endangered	0	0	0	0	0	0	0	0

Evaluation Criteria	Alignments							
	Mulford (Entire Segment)	Mulford / Niles / Hayward	Mulford / Niles / WPRR	Mulford / Tunnel / Hayward	Mulford / Tunnel / WPRR	I-880 (Entire Segment)	I-880 / Hayward	I-880 / WPRR
Area of Alignment within Sensitive Habitat (per CNDDB)	**382,631**	**320,615**	**313,301**	**262,483**	**271,282**	**221,455**	**255,921**	**464,067**
Minimize Impacts to Social and Economic Resources.								
ENVIRONMENTAL JUSTICE IMPACTS (Demographics)	4	2	3	3	4	5	2	3
# Block groups >50 percent minority	63	66	63	63	59	52	59	55
# Block groups >50 percent low-Income	0	0	1	0	1	1	1	2
Potentially affected minority population	13,090	16,689	15,285	15,427	13,956	11,405	15,791	14,321
Potentially affected low-income population	0	0	0	0	0	14	14	14
FARMLAND IMPACTS	1	2	2	3	3	5	4	4
Area of prime farmland (square meters)	48,099	12,875	12,875	12,947	12,947	30,489	54,805	54,805
Area of unique farmland (square meters)	45,569	38,605	38,605	0	0	0	0	0
Area of farmland of Statewide importance (square meters)	3,988	3,988	3,988	3,988	3,988	0	0	0
Minimize Impacts to Cultural Resources.								
CULTRUAL RESOURCES IMPACTS	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
PARKS & RECREATION / WILDLIFE REFUGE IMPACTS	1	1	1	1	1	5	3	3
	• Passes through Don Edwards National Wildlife Refuge • Extremely Sensitive biological resource area						• - Passes through Fremont Central Park Lake	
Maximize Avoidance of Areas with Geologic and Soils Constraints.								
Soils / Slope Constraints	5	3	3	4	4	4	4	4
Area of Highly Erodible Soils (square meters)	759,411	1,261,971	1,271,056	1,256,284	1,270,645	1,148,815	1,270,251	1,279,336
Area of High Shrink/Swell Soils (square meters)	1,740,288	1,933,528	1,973,293	1,737,344	1,767,536	1,714,710	1,725,691	1,750,639
Area of Steep Slopes - greater the 9 percent (square meters)	0	0	0	0	0	0	0	0
Seismic Constraints	4	3	2	1	1	5	3	2
	• Silver Creek Fault 3 times	• Silver Creek Fault once • Hayward Fault twice	• Silver Creek Fault once • Hayward Fault 3 times	• Silver Creek Fault once & adjacent to Hayward Fault in Fremont	• Silver Creek Fault once & adjacent to Hayward Fault for several miles	• Cross Silver Creek Fault once	• Silver Creek Fault once • Hayward Fault twice	• Silver Creek Fault once • Hayward Fault 3 times
	• All high-speed train facilities would be designed taking into account existing soil, groundwater, and geologic conditions in the area and to withstand maximum credible earthquakes from fault activity in the area.							

1 2 3 4 5

Least Favorable **Most Favorable**

Table 4.3-2
Bay Area-to-Merced Corridor -- High-Speed Train Station Evaluation Matrix
San Jose-to-Oakland Segment

Evaluation Criteria	Station: South Alameda Co.	Station: Oakland Airport/Coliseum	Station: Oakland Terminal Station
	Mowry Avenue (I-880 Alignment Only)	**Coliseum BART Station (Mulford/Hayward Alignment Only)**	**West Oakland**
	Auto Mall Parkway (Mulford Alignments Only)	**Coliseum BART Station (Mulford/Hayward/WPRR Alignment Only)**	**Lake Merritt**
	Warm Springs (I-880/Hayward & WPRR Alignments Only)	**I-880/Hagenberger Rd. (I-880 Alignment Only)**	**12th/City Center**
	OR Union City (I-880/Hayward & WPRR Alignments Only)		**Jack London Square**
Maximize Ridership/Revenue Potential.			
POPULATION/EMPLOYMENT CATCHMENT (Year 2020)	4	3	5
	• 808,533 employment • 462,395 population	• 593,747 employment • 250,185 population	• 2,565,241 employment • 1,244,401 population (Assumes station in downtown San Francisco)
Maximize Connectivity and Accessibility.			
INTERMODAL CONNECTIONS	4	5	5
	5	5	3
	5	4	5
	5		3
	• I-880 Freeway	• BART • Capital commuter rail • AC Transit buses • Connector to Oakland Airport	• All BART lines • AC Transit buses
	• I-880 Freeway (1.5 mi.) • Capitol commuter rail • ACE commuter rail • AC Transit buses	• BART • Capital commuter rail • AC Transit buses • Connector to Oakland Airport	• 2 BART lines • AC Transit buses
	• BART • AC Transit buses	• AC Transit buses • Connector to Oakland Airport	• All BART lines • AC Transit buses
	• BART • Capital commuter rail • AC Transit buses		• Amtrak • Capitol commuter rail • AC transit buses
Minimize Operating and Capital Costs.			
OPERATIONAL ISSUES	5	5	4
	• None apparent at this time	• Potential joint use by rail transit providers for Mulford and Hayward • None apparent at this time	• All terminals are designed as two track terminals. All can be expanded to four tracks – West Oakland at 1 level & the others at 2 levels. All terminals have tailtracks for storage & inspection, minor servicing & catering

Evaluation Criteria	Station: South Alameda Co.	Station: Oakland Airport/Coliseum	Station: Oakland Terminal Station
	Mowry Avenue (I-880 Alignment Only)	**Coliseum BART Station (Mulford/Hayward Alignment Only)**	**West Oakland**
	Auto Mall Parkway (Mulford Alignments Only)	**Coliseum BART Station (Mulford/Hayward/WPRR Alignment Only)**	**Lake Merritt**
	Warm Springs (I-880/Hayward & WPRR Alignments Only)	**I-880/Hagenberger Rd. (I-880 Alignment Only)**	**12th/City Center**
	OR Union City (I-880/Hayward & WPRR Alignments Only)		**Jack London Square**
CONSTRUCTION ISSUES	1	4	2
	5	5	3
	1	5	2
	5		1
	• Construction over active freeway	• WPRR would require construction of aerial structure & station directly adjacent to the BART aerial station	• Deep tunneling through Embarcadero area
	• None apparent at this time		• Tunneling beneath Laney College
	• Relocation of BART & constructing between two operating railroads		• Cut-and-cover, deep tunneling, & deep excavation. Construction under BART station
	• None apparent at this time		• Deep tunneling through Embarcadero area & mining of concourse area in Bay mud. • Construction under active railroad
CAPITAL COST	• Highest cost	• Similar costs	• Less cost
	• Lowest cost		• Lowest cost
	• Less cost		• Less cost
	• Less cost		• Highest cost
RIGHT-OF-WAY ISSUES/COSTS	• Highest cost	• Similar costs	• Highest cost
	• Highest cost		• Highest cost
	• Highest cost		• Lowest cost
	• Lowest cost		• Highest cost
Maximize Compatibility with Existing and Planned Development.			
LAND USE COMPATIBILITY AND CONFLICTS	5	5	3
			3
			5
			5
	• Compatible land uses • Mowry Station requires taking commercial property – compatible	• Compatible land uses	• Adjacent to BART in mixed-use area, including residential, commercial & light industrial
	• Compatible land uses	• Compatible land uses	• Underground in mixed use area, including residential & commercial
	• Compatible land uses	• Requires taking commercial property	• In highly developed commercial area – compatible
	• Compatible land uses		• Below existing train terminal – compatible

Evaluation Criteria	Station: South Alameda Co.	Station: Oakland Airport/ Coliseum	Station: Oakland Terminal Station
	Mowry Avenue (I-880 Alignment Only)	**Coliseum BART Station (Mulford/Hayward Alignment Only)**	**West Oakland**
	Auto Mall Parkway (Mulford Alignments Only)	**Coliseum BART Station (Mulford/Hayward/WPRR Alignment Only)**	**Lake Merritt**
	Warm Springs (I-880/Hayward & WPRR Alignments Only)	**I-880/Hagenberger Rd. (I-880 Alignment Only)**	**12th/City Center**
	OR Union City (I-880/Hayward & WPRR Alignments Only)		**Jack London Square**
VISUAL QUALITY IMPACTS	3	5	5
	5	5	
	5	3	
	5		
	• Minimal visual impact except Mowry Avenue with high visual impact.	• High visual impact for approach structure for I-880 Station • Other stations directly adjacent to existing major transit stations – minimal visual impact	• Minimal visual impact except for entryways that would need to designed to be attractive and easily distinguished
Minimize Impacts to Natural Resources.			
WATER RESOURCES	5		
	• None of the stations are expected to have impacts to critical water resources		
FLOODPLAIN IMPACTS	5	5	
	4		
	5		
	5		
	• Auto Mall Parkway Station in floodplain	• No stations in floodplain	
THREATENED & ENDANGERED SPECIES IMPACTS	5		
	• No threatened or endangered species were identified for the station areas		
Minimize Impacts to Social and Economic Resources.			
ENVIRONMENTAL JUSTICE IMPACTS (Demographics)	5	5	3
		5	3
		3	5
			5
	• All stations are within existing transportation corridors. • The Mowry Avenue site would be closest to residential areas	• The WPRR Station would be closest to minority housing	• The West Oakland Station is adjacent to minority housing as is the Lake Merritt. City Center and Jack London Square are in primarily commercial areas
FARMLAND IMAPCTS	5		

Evaluation Criteria	Station		
	South Alameda Co.	**Oakland Airport/ Coliseum**	**Oakland Terminal Station**
	Mowry Avenue (I-880 Alignment Only)	**Coliseum BART Station (Mulford/Hayward Alignment Only)**	**West Oakland**
	Auto Mall Parkway (Mulford Alignments Only)	**Coliseum BART Station (Mulford/Hayward/WPRR Alignment Only)**	**Lake Merritt**
	Warm Springs (I-880/Hayward & WPRR Alignments Only)	**I-880/Hagenberger Rd. (I-880 Alignment Only)**	**12th/City Center**
	OR Union City (I-880/Hayward & WPRR Alignments Only)		**Jack London Square**
	• No stations located on prime farmland.		
Minimize Impacts to Cultural Resources.			
CULTURAL RESOURCES IMPACTS	5		
	• None of the stations are in areas with known cultural resources – no affirmative survey conducted		
PARKS RECREATION/WILDLIFE REFUGE IMPACTS	5	5	
	3		
	5		
	5		
	• The Mulford alignment Station is adjacent to the Wildlife refuge • All other stations would not affect Parks/Recreation/or Wildlife refuge	• No station would affect Parks/Recreation/or Wildlife refuge	

1 2 3 4 5

Least Favorable **Most Favorable**

5.0 REFERENCES

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